EXECUTIVE STATISTICAL CONTROL

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PREFACE

Early in 1917 English industrial leaders were stating frankly in print that the salvation of the state, of capital and of labor after the war, would depend upon the nation's income, which in turn would depend upon the reduction of production costs sufficiently to allow over-seas competition to be met. In fact, a growing conviction developed among progressive thinkers in England that the interest of the state, whose policy would be largely directed by labor, would after the war be forced to the consideration of labor efficiency secured through some form of scientific management. Strange as it may seem, in a country long noted for its ultra-conservatism, scientific management has been regarded as an aid to labor much more widely in England than in America.

If competition becomes a race between separate nations, America must strain every nerve to the attainment of industrial efficiency. If competition resolves itself into economic war between groups of nations, America must be prepared rather to aid than to clog the industrial progress of her allies. If competition is replaced by the industrial millenium of the Internationalists, all that America can teach the world by example—reducing the expenditure of labor required per unit of production, and so aiding humanity by the reduction of fatigue and by the cheapening of both ncessities and luxuries—will be received with acclaim.

Every man, woman, or child who can assist in fitting his country to meet the future fearlessly and successfully is assisting humanity. After the destruction and cataclysm of war,

unnecessary waste of labor or of material is little less than criminal. The executive—be he president of a world-wide corporation or straw boss in a construction camp at the ends of civilization—who can so conduct the work which has been intrusted to him that every co-worker will save something, either labor or material, which otherwise would be lost to the world is assisting reconstruction. Every industrial engineer and every teacher who can assist an executive, a laborer, or a child to comprehend and to practice conservation at such a time is assisting the race.

In preparing the following pages, in which I have endeavored to detail the facts the industrial executive should have always before him and to explain why he requires such facts to conduct effectively the business for which he has assumed the responsibility, I have drawn very freely upon knowledge secured as a manual laborer, as an executive, and as an engineer for a period covering some fifteen years. Under the circumstances it is manifestly impossible to enumerate the sources of my information and to give credit where it is due. However, I feel especially indebted to the late Frederick W. Taylor, both for his books and for his personal assistance, given me freely at a time when he could ill afford it; to H. L. Gantt whose eminently practical view-point led me to realize that the material return to both capital and labor from scientific management could be successfully set forth without injury to the ideals of the best of either; to Harrington Emerson as a continual source of inspiration during my association with the Emerson Company, and to D. M. Hyman and certain of his associates from whom I gained an intimate knowledge of and respect for the methods which render the large corporation executive successful.

Dwight T. Farnham.

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EXECUTIVE STATISTICAL CONTROL

CHAPTER I

THE EXECUTIVE AND THE MODERN ORGANIZATION

Field for Scientific Management.—Too much scientific management work begins and ends only in the factory. This is perhaps natural, as the industrial engineer is usually engaged by the chief executive to standardize manufacturing conditions rather than to educate the higher executives, and it very often does not occur to those in charge of a large corporation that the other branches of the business should be just as carefully standardized in order that highest efficiency may be obtained.

One striking example will be enough to illustrate what may occur when the factory is regarded as the only field for decisions scientifically reached. A number of years ago, a concern capitalized at several hundred thousand dollars engaged some engineers to introduce efficiency methods into the factory. Officials of the company became very enthusiastic over the work. The general manager spent a great deal of time at the plant studying the methods. Production went up by leaps and bounds, and the cost of manufacture steadily decreased. Each month, as the progress became more noticeable, the executives were

more pleased. Suddenly something occurred which surpassed the expectations of even the wildest enthusiast—direct costs dropped to absolute zero! The concern had run out of orders and no units were being produced.

Cases of this sort fortunately are not common, but nevertheless in every business conditions are such that there is a large field outside the factory to which the principles of scientific management can be applied to great advantage.

Salesmanship as an Example.—Scientific salesmanship consists largely in the application of certain principles of psychology to selling with a view to developing a convincing personality in the salesman. Certain aspects of marketing are covered fairly exhaustively by some of the advertising companies, the better sort of which, after a careful investigation along scientific lines, will give their client a very fair idea of the territory in which his product can be most advantageously placed, the selling price which will bring him the largest return, and the proper method of placing the product before the public. In connection with the method they emphasize the importance of the style of container, the method of presentation and the advertising media. How far the executive should go as regards either encouraging his salesmen to study the various courses in applied psychology or engaging the expert in marketing to analyze his selling field, depends, of course, upon the nature of the business. Both these lines of endeavor are somewhat outside the scope of what is generally understood as scientific management, although both

may be recommended upon occasion by the engineer.

There is no question, however, about the great need for a much more general application of scientific principles in the sales department. For the most part salesmen and sales managers are paid straight salaries, or salaries together with commissions on sales. The first method is strictly comparable to the day-wage system of payment, in accordance with which the workers are paid for time served, irrespective of accomplishment; under such circumstances the only incentive is the fear of discharge. The second method is worse than the old-fashioned piece-rate system. The commission-on-sales plan influences the salesman to attempt to cut prices, and involves the necessity of his convincing the firm that such action is necessary in his particular territory. Any sales manager has only to analyze his reasons for not allowing his men to carry a "side line" to realize how much greater an incentive a direct and personal interest in his line is to a man than any incentive furnished by the usual method of payment.

Salesmen should be paid, not to cut prices, but to exert every possible effort to increase the net profits of the firm, in the quantity of goods sold, the price per unit obtained, and to reduce the sales expense incurred. Whenever the plan is practicable, they should be rewarded also for their attainment of the firm's ideals in regard to the treatment of customers as well as concerning other policies upon which the expansion and the ultimate success of the business depends. This method can be used, and is being used; moreover, wherever it has been carefully

worked out and consistently applied by the right kind of executive, it has done as much for the sales department as the bonus reward system has done for the factory.

It is not the purpose to treat in detail at this time the methods of the application of scientific principles to any particular department, but rather to outline a method by means of which the executive may obtain the utmost efficiency in every department. This end he will accomplish by properly co-ordinating all departments, by carefully subordinating the minor departments according to their relative importance, and by establishing the ratchet principle, which automatically prevents the loss of any advantage gained—in other words, by the application of science to administration through the medium of statistical control.

Growth of Corporations.—Formerly, before the economic changes that came with the steam engine resulted in the creation of our industrial armies, the owner of a business was its chief executive and very often assumed the duties of half a dozen other officers, even usurping in some cases duties which the expert accountant would now classify under the head of janitor service. He was in personal touch with every detail of the business. He knew personally every employee, and sometimes all the members of each employee's family also. Such intimate knowledge of personnel and conditions is now obviously impossible. It is hard to realize that if Henry Ford wish to chat with each of his employees for an hour, if he chatted ten hours a day he would finish up with his office boys about three years from now.

Business has progressed so fast in America, and corporations have grown so rapidly, that the complexities have in many cases become more than a single human mind can grasp. According to Darwin, evolution takes time, and we all know that our supermen haven't been developed as fast as our "super-corporations." Hence the country-wide search for super executives, and the innumerable physical and mental breakdowns among executives. And this lack of super-men is also responsible in great measure for the fact that only about half the corporations in the country pay dividends. Bradstreet attributes more than a quarter of all the business failures to incompetence, and five per cent to inexperience. "Our intentions were all right, but we haven't been able to stand the strain," is the explanation often heard in connection with business failure.

We have all of us seen businesses which have prospered and expanded, and yet have eventually gone on the rocks. They were prosperous as long as all was under the eye of the proprietor, but when he had to delegate some of his authority to others, things began to go wrong. He could manage details himself, but details increased too fast for him. He had always looked into everything personally. As the business grew, he resembled more and more a Marathon racer on the last lap, straining every nerve to keep up with the rest. If he had an iron constitution he didn't fall by the way, but even then the business ceased to prosper. Of course, in America the great god Luck will very often see a corporation through such periods.

Prosperity Versus Success.—Not long ago a big financier indicated very clearly that prosperity is not necessarily a guarantee of success when he advised a young man in the following words against entering the employ of a large and prosperous corporation in which he hoped to gain business experience: "Get a job with a concern that is losing money, or that's just keeping its head above water. You'll learn something about business there. Lots of these fellows that are earning big dividends are throwing away as much as they are making. They don't know it, and you'll learn bad habits."

America's business success is perhaps not so clearly attributable to the looting of natural resources as some of our conservationists would have us believe, but nevertheless financial success has ensued in spite of bad management much more often than some of our self-made millionaires would be inclined to admit. The business that is barely making dividends is like a man who has been scared by his physician—it is taking care of itself. The business that is making large dividends isn't spending time in self-analysis. It grows large and fat and hearty, until some day the hidden weakness within causes its collapse and it comes down with a crash that shakes the financial world.

Careful bankers will tell the investor that if he wants to be absolutely sure of his principal he had better stick to securities paying between four and five per cent; that if he is willing to take a little risk, mortgages are all right up to, say, six per cent; but that if he is going to invest in a manufacturing

proposition, as a general rule he ought to have at least eight or ten per cent to cover the additional risk incurred in industrials. It is very easy to attribute the existence of this risk to "tariff monkeying" or to "politics," but it is not so easy to remedy conditions. Whatever the explanation, the fact remains that "industrials" are risky in America.

Politics, business conditions, and other general causes are too often blamed in this country for business troubles. It is much easier to say that hard times or the weaknesses of the Administration are responsible than to analyze one's own business thoroughly, to arrive at the fundamentals underlying fluctuations, and to provide against the lean years firmly and consistently. It is a great temptation to the president of a corporation to gain the plaudits of his stockholders by paying a ten or twenty per cent dividend. Stockholders who advance their scale of living in accordance with a policy of this sort are not pleased when dividends are passed; and the executive who has been tempted into this "after us the deluge" policy usually finds his flood arriving strictly on schedule—there is a change in administration; all that he and his associates learned at the expense of the stockholders departs with them, and another administrative force must be educated. Careful and intelligent analysis of the business would have prevented all this. Dividends might not have gone over seven per cent, but there would have been a sinking fund sufficient to provide for periods of stress, and the business would not have had to furnish a training course for executives.

Strain upon the Modern Executive.—The official position of our modern executive is no sinecure; rapid industrial expansion has given rise to innumerable problems that he must solve. He has to run the business. Decision after decision is required of him on short notice, until sometimes it seems to the overworked business manager that emergencies follow one another with the rapidity of shots from a machine gun. The strain of having to render decisions of an unusual nature without being able to make adequate investigation, and often in the knowledge that thousands of dollars depend upon each such decision, is terrific and sooner or later will bring disaster either to the executive or to the business. For this reason, more and more executives are reserving a portion of their time for the contemplation of the larger problems of their business. They are organizing statistical departments—not the kind marked by dusty cubby holes and run by dried up clerks on tall stools adding endless columns of figures which are filed away among the cobwebs, but live departments thoroughly supplied with information as to the ideals and the objects of the business, having as assistants young men who visit and investigate the factories and who will ultimately become valuable executives. These helpers keep the chief executive thoroughly informed concerning the conditions and the tendencies of the business. With complete information at his command in a form easily comprehended, the executive, when a problem arises, can retire to his office and in a comparatively short time grasp the whole situation and plan his course of

action intelligently. Under such circumstances it is a pleasure for him to make decisions for he is not merely making a jump in the dark.

English and American Methods Contrasted.—Many American business men do not understand fully the conservation of their energies. Too many of them, because they have few interests outside their business, are inclined to spend long hours at the office. The business day of the Englishman is in strong contrast to that of the American. Any one who has done business in England or in Canada has been first exasperated and then amused by the (ten to four o'clock with two hours off for lunch) office hours of our British cousins—but further acquaintance with their method of doing business convinces a man that there is something to be said for the system. English business men accomplish about as much in six or seven hours a day as American business men accomplish in eight or nine. And most Englishmen look younger at fifty than most Americans do at forty.

Shortly after the beginning of the war I called upon the general manager of the Daimler Motor Company in Coventry. Considering the fact that the company was fairly overwhelmed with war orders, I was surprised that he could grant me any time at all. His reception of my call was a marvel of diplomacy. He made me feel that he was placing his whole day at my disposal, and yet he gave me all the information I wanted and got rid of me in about ten minutes! It would have been impossible, in all probability, to reach an American executive under similar circumstances, but even if you did you would find him

armed with a manner implying "I am an extremely busy man—say what you've got to say and get out," or else he would have wasted three-quarters of an hour on you.

Recently, a Frenchman, in criticising our strenuous, rather than effective, business methods, referred to our stenographical system. He had observed the following case: A man rushed into a New York hotel, dictated half a letter to a girl, which she took directly on the machine "to save time," tore that letter up, re-dictated part of it, and tore that up. Finally, at the third trial, after spending three-quarters of an hour of his own and the stenographer's time in the most frenzied and nerve-racking fashion, he completed a simple letter which, as my French friend said, "My secretary, Louis, would have written by himself after a word or two of comment from me, in fifteen minutes, meantime saving forty minutes of my time and thirty minutes of his own, to say nothing of endless nerve force."

I have seen men in control of million-dollar corporations dictate with great pains letters which their stenographers could have written just as well in half the time from a marginal notation that could have been made by the executive in an instant. I have seen presidents of companies that serve half the country spend thirty minutes in personally revising a telegram in order to save a few words. It is "the fashion" among our business men to be rushed to death, and unfortunately too many of us sacrifice our own health and the efficiency of our business just to be in the fashion.

Subordination of Detail.—The proper subordination of detail is an art. We have only so many minutes each day, and the executive who will consistently set aside half an hour every day to plan what he will do the remainder of the day, and then stick to that plan, will be surprised to find how much of his work can be taken care of by subordinates and how much more time he can devote to constructive thinking and to the consideration of matters of real importance.

But it is necessary for the executive, besides conserving his own time by the proper subordination of details and the delegation of them to others, to train an efficient organization. Perhaps the most important factor in such training is the ability of a man to inspire the confidence among his subordinates which insures open-mindedness and a willingness to learn.

Formerly, an owner in passing among his employees could investigate conditions thoroughly and admonish and inspire each individual workman. If any problem arose, he could personally keep in touch with the situation and with the workman or workmen concerned until he reached the right decision in the matter. All that, however, has been changed. Today it is impossible for the executive of a large concern to keep in touch with all the conditions of his business and with all his employees. An executive in New York may give an order that is executed in Chicago, or even in San Francisco. The remarkable fact, under the circumstances, is that orders are issued correctly and carried out right as often as they are. There are many chances of error—in the

transmission of the order and in the receipt of it. The order may be worded vaguely, or even a clearly worded order may be carelessly interpreted. How can the executive, then, insure that his order will accomplish the objects that he has in mind? The answer, of course, is that he must have an efficient and well trained organization—an organization that will transmit the chief's exact intention quickly and intelligently to the furthermost confines of the business.

CHAPTER II

THE MIND AND METHODS OF THE EXECUTIVE

The Narrow-Minded Executive.—At the root of all organization lies absolute fairness—a willingness to consider each question strictly upon a basis of the facts, without bias and without favor. A certain old-time railroad builder, a man of great personality and power, was in the habit of making his promotions on the basis of intuition and personal liking. He would drop off at some tank station at two o'clock in the morning, where a light in the window showed a station agent poring over his way-bills even at that hour—as likely as not because he didn't have brains enough to get his work done during regular hours—and promote that agent, probably over the heads of a score of men who could do their work in the time allotted. And, conversely, he would chop off the head of some executive because he happened to be apparently idle when the "boss" came along. For all that railroad president knew, the unlucky executive may have been devising some scheme to save the road thousands; but since he couldn't see the man's brain work, he used the axe. I was so unfortunate as to have to travel over this road on several occasions, and I found the disorganization appalling. A remark made one day by an engineer of the road summed up

the whole situation. "I don't know when I'll get canned, but if I know twenty-four hours beforehand this blasted railroad will lose an engine." Unfairness in those in command is a menace to any organization,

Uncontrolled vanity is another rock upon which many a business is wrecked. To be sure, a certain amount of vanity is desirable. If mankind had not been plentifully supplied with vanity, the race would have died out long ago, for in that case men would see themselves as others see them, and the suicide statistics would have exceeded the birth rate. If a man is to inspire confidence in others, a good strong faith in himself and a respect for his own ability is absolutely essential. It is absolutely essential that an executive inspire confidence in his subordinates if he is to secure results. But it is a delicate matter to show just a sufficient amount of vanity and yet not too much.

A few years ago one of our humorists made the statement that golf was ruining America because it was prolonging lives that were detrimental to this country's best interests. He figured it out that every man who exerts himself sufficiently to become a captain of industry begins to suffer from the early stages of paralysis before he is fifty. This disorder, he stated, in the beginning takes the form of violent megalomania (an extreme case of vanity) which results in raids by one group of capitalists upon another, that disorganizes business, and hurts the whole country. Now, this man claimed, if golf hadn't been invented to prolong the careers of these megalo-

maniacs they would be where they should be, in their graves, or locked up in asylums, before they could do any harm. This argument savors of the wit of the court jester in its combination of absurdity and unpleasant truth. But any one who has ever been in a position to observe the inefficiencies existing in any business in which the pet ideas of the "old man" must be considered at all times, where no new project can be broached without a careful consideration of whether it will mean treading on the toes of any of his whims, where favor stalks abroad and ability cowers in fear of self-expression, knows of the terrible inefficiency for which vanity is sometimes responsible.

Feudal Type of Organization.—The origin of the destructive type of organization—our modern remnant of the feudal system—may often be traced to the uncontrollable vanity of its liege lord, be he owner or chief executive. There seems to be something in human nature which, no matter how old we are, makes us desire to have some one to run to for assistance in time of trouble, just as we ran to our father in our childhood when the small boy across the street got the better of us in a fight.

In feudal times, every serf in time of foray ran for protection to the baron to whom he professed allegiance. This baron was bound to defend him no matter what crime the serf had committed, or lose the man's allegiance and be one serf the poorer. Conversely in the latter event some rival baron would be one serf the richer, so the first baron would suffer in two ways. Whenever the chief executive in a large corporation is weak enough to allow his fears to be

played upon by strong subordinates, or vain enough to allow his judgment to be influenced by the flattery of "court favorites," the politics of the feudal system are reproduced with the chief executive as king and his assistant executives as warring barons, and the organization devotes itself to the joys of the political game instead of to earning dividends for the stockholders.

Under such circumstances each executive, taking his cue from his superior, builds up about him a staff of assistants, specialists, clerks, and stenographers, and his prestige as compared with that of his rival executives is measured by the extent of his vassalage. Whenever he feels strong enough, having done the "king" some special service, or having weakened a rival sufficiently, he annexes a neighboring "barony" bodily—baron, assistants, clerks, and stenographers, included, all of whom pass under the yoke rather than be cast forth from the kingdom. Advancement in such a company becomes a matter of skill in politics, rather than of ability. Consistent effort to promote the company's interests gives way to desperate attempts on the part of each executive to advance his own personal interests. A state of continual turmoil results, foray follows foray, and the company suffers.

Loss to the company is sure to result, since these executives are the highest priced employees of the company—men paid large salaries on account of their superior brains and their ability to conduct the company's business successfully. When the feudal spirit prevails, the time these men give to politics—a third of their time is a conservative estimate in many cases

—one-third of the executive payroll is wasted. In addition, the ambition for personal aggrandizement leads to the creation of unnecessary staffs and to the hampering of existing departments with members who are not needed. Such a policy places upon the payroll a burden that could just as well be avoided. Worst of all, the best thought and the best effort of each executive, which should constitute the greatest asset and profit-producer of the company, is devoted, not to furthering the company's welfare, but to devising ways and means of a devious nature to bring about a rival executive's downfall.

Men of ability are driven forth from such an organization simply because they won't play that kind of game. Those that reach the top do so through aggressiveness alone. With men in control who secured their positions through sheer aggressiveness, decisions in regard to the company's policy, vital to its very existence, are forced by sheer weight of personality, as a result of one man's ability to shout the loudest or the longest, instead of being reached by means of a careful analysis of existing conditions. When policy is determined by lung power instead of by brain power, it is not surprising if the business venture goes on the rocks. The safest type of vanity for the executive is that of Warwick the King-Maker, the power behind the throne, the type which in politics holds no office, the type which is too proud to be vain or to grab the limelight.

Executive and Subordinates.—One of the ablest managers I know calls himself the man without a job. He is the most quiet and unassuming person in his

organization. He will tell you that about a dozen committees run the business, some of which meet once a week, some twice a week, and some oftener. Undoubtedly what he says is true. But he doesn't say anything about who trained the men that make up these committees. Nevertheless you only have to watch him a few minutes with one of his executives, and to note the utter frankness and trust with which he is approached and the fine straight-forward suggestions he encourages, to understand who is responsible for that company's efficiency. You realize then that he put over the biggest deal in the history of that company when he threw his vanity overboard. He is getting 100 per cent results out of every man in his force, and I don't need to tell you that stock in that company is worth a price which would make a "war baby" blush with shame.

There is something about an appetite for praise which resembles a craving for opium. The more the victim takes, the more it requires to satisfy him. After a while, a delicate compliment become absolutely tasteless. The victim craves larger and larger doses of praise until finally you have to put it on with a shovel. The executive who demands compliments, who is continually angling for praise, and who is always thinking about his dignity, has very little time to do anything else. The right sort of men will not remain with one of these megalomaniacs; consequently the business suffers. It was all right to play "big Injun" when the business could be housed in a single tepee, but that day is gone by; the successful chief of to-day must have strong, self-respect-

ing executives to assist him—men who demand the right to speak the truth freely—and that sort will remain only with an executive who sinks his vanity and plays the game straight. Furthermore, in order to secure real assistance from his subordinates, the executive must be prepared to back them to the limit in their decisions. Nothing so takes the heart out of a man as having the orders he gives countermanded by his boss. Such humiliation brings upon him the derision of his associates and destroys his initiative.

Besides, there is always a type of man present in every organization who enjoys going over the head of his immediate boss for orders, just for the satisfaction of slapping his superior in the face with contrary orders from the "old man." Where this sort of thing is countenanced, you will always find political intrigue instead of efficiency. It is, to be sure, sometimes a delicate matter to support a subordinate in a decision, especially if the decision is wrong. It can generally be done, however, without sacrificing any one's prestige, if the chief executive has tact—and the gratitude of the subordinate under such circumstances is one of the things that make an organization impregnable.

The best remedy for political intrigue, aside from the supervision of an executive with a firm hand and the wisdom of the serpent, is a carefully drawn organization chart. If each man knows definitely just who is over him, and over just whom he has authority, and knows that he will get his knuckles rapped the first time he places his hand on his neighbor's fence, he won't try to encroach upon his fellow-

executive's preserves; and conflict of authority and much bitterness will be avoided.

It is needless to say that an executive, to be successful, must have the respect of his assistants. He need not be "popular;" in fact, it is perhaps better that he should not be too much of a "hail fellow well met." There is a reason for the army rule that officers shall not drink with "non-coms" and that "non-coms" shall not drink with privates, and human nature is the same in business as in the army. A reputation for fair dealing, a willingness to listen to the whole story in case of a grievance, and an absence of anything savoring of "side" counts for much more in the officers of a corporation than any amount of cheap popularity.

Exact Knowledge a Necessity.—An exact knowledge of conditions and the consequent opportunity for the timely administering of praise or of constructive criticism are extremely valuable to the executive who would secure satisfactory results. Undeserved criticism is always considered unjust by the subordinate and destroys his initiative; unmerited praise tends to render the executive ridiculous even in the eyes of those who receive it. Both are bad for discipline, since they weaken the power of the executive.

Cost figures may have historical interest, but they are not worth one tenth the expense of assembling unless they aid actively in the administration of the business. The problem of the executive, then—once his organization is perfected—is to secure at all times live and accurate data concerning the exact conditions of the business; moreover, he must accomplish his

object with the least possible expenditure of his time. The facts must be subordinated according to their relative importance as measured by their effect upon the ultimate dollar in the form of dividends to his stockholders. Furthermore, the facts must be so arranged that the general laws underlying the business may be easily and accurately deduced and standards of accomplishment may be set which will be a continual incentive to greater accomplishment.

The head of a large corporation necessarily forms his judgments largely from the perusal of various reports, tabulations of figures, and statistical data compiled by his assistants. He cannot talk with all his subordinates at length, and therefore if he is to succeed in grasping the details, a knowledge of which is necessary for the administration of a large business, he must do so by developing what psychologists call an "eye mind" rather than an "ear mind." That is, his mind must be so constituted that it will grasp facts much more quickly and surely through the medium of the eye than through the medium of the ear. His must be the type of mind that receives a clearer and more lasting impression from a picture than from an oral statement.

If, then, a picture can be arranged which will give the executive at a glance the exact state of his entire business, with details subordinated in the order of their importance, so that the more important facts stand boldly in the foreground where they cannot be overlooked, and the less important, though present, are in minor positions, where they will receive attention only when necessary—the executive will be en-

abled to understand and to direct his business with an intelligence and a sureness of touch which will insure his stockholders' getting every possible cent out of it.

Scientific Forecasting.—There is nothing new about the use of the graph or curve chart in business but, so far, it has been most used by the following two classes: First, engineers, in making physical tests—from showing the oscillations of a needle registering the millevolts generated by a platinum-rhodium thermocouple in a high temperature furnace, to demonstrating the fluctuations in the steam pressure in a ten-thousand-horsepower plant; and second, students of finance, in platting the behavior of a group of stocks or proving the state of the bank reserves over a certain period.

A few years ago some of our more progressive corporations began showing by means of graphs the fluctuations of their sales in different districts, and later the same method was applied to costs. It is only recently, however, that anything like a comprehensive graph method applicable to an entire business has been worked out and put into effect. Within the last few years several large corporations have gone a step further. They have not only shown by means of graphs what they have done and are doing in their work, but also what they propose to do. And the most remarkable thing about these prophecies by graph is the regularity and exactness with which the ideals aimed at have been realized.

Not long ago I was privileged to go over a series of graphs of this nature arranged by the president of

one of the largest corporations in the Middle West. These graphs predicted for a period of more than a year, and some three months in advance, the quantity of sales, the selling price, the cost of production and the amount of production of a commodity which is noted for its instability of demand, for the irregularity of the cost of production and for the fluctuation in market price. The actual accomplishment as shown by the graphs hit so often and with such regularity the standard set that if I had not known the president of the company to be a man of unimpeachable integrity I should have found it hard to believe that the curves actually represented predictions.

The possibility of making prophesies of this sort seems almost incredible to one unfamiliar with standardization work in general. But it seems only logical to any one who knows the accuracy with which—say, in time-study work—an examination of existing conditions enables one to predict what can be done, and who has seen how exactly accomplishment coincides with the standard once conditions are standardized and the necessary incentive is supplied.

Analysis An Aid In Forecasting.—It is absolutely essential, first of all, to analyze existing conditions. It is extremely difficult for the executive to do this scientifically when the usual types of balance sheets and cost records are in use. Ordinarily he looks at these when they arrive, about the twentieth of the month, and if they seem to him satisfactory in the light of what he happens to remember about past performances, he lays them aside and returns to his routine. A sudden drop in profits or a rise in costs

forecasts both a raid on the sales department or upon the factory, and a demand for an explanation. Usually the heads of both these departments know what kind of answer will satisfy the "old man." They parade forth the ancient bogeys of competition or of interrupted output and the executive, lulled to a feeling of security, goes back to his desk.

This is all that happens unless there is a prolonged period of low profit, in which case the directors come in and hold a post mortem. After an investigation—marked by considerable bad feeling—of the office rent and the amount spent for postage, telegrams and the salaries of the stenographers (I have seen board meetings over exactly this sort of trash), a "period of retrenchment" is declared to be vital. The office force is cut down and the superintendents are deprived of their stenographers. A man here and there whose name appears on the "non-productive" side of the ledger is dismissed and the "overhead" is reduced. When all is done the directors don't know any more about the real cause of the falling off in business than they did before. The worst feature of all is that the retrenchment has killed the only part of their organization which could tell them!

Perhaps the directors are not so much to blame, however, as they seem to be. The statistics prepared by only too many cost-keeping departments are misleading rather than enlightening, even to the executive—and perhaps the less of them the better. Masses of figures come to him each month which cannot possibly be remembered until the next month. As a result, each set of conditions has to be con-

sidered largely by itself or merely as contrasted with that of some other single month. The very volume of the statistics makes it a physical impossibility to lay the records out on a table and to compare the figures for more than a few months at a time. It is impossible to determine by such a system the laws underlying fluctuations in costs, in sales prices or in profits. Yet predictions as to future conditions cannot possibly be made unless these laws are known.

It is my purpose to indicate in the following pages, by means of concrete illustrations, just how the facts —all the facts—for a considerable period may be brought before the executive at one time, in the exact order of their importance and with sufficient insistence to render it easier for him to make the right decision than the wrong one. I shall discuss various methods of accomplishing this end, and I shall use examples from my own experience as an executive and as a consulting engineer.

Inasmuch as the illustrations used are in most cases drawn from actual and recent occurrences in various corporations, for obvious reasons hypothetical figures only will be used. Furthermore, an effort will be made in each case to illustrate the principle only, without indulging in too detailed discussion of specific manufacturing processes. Of course, in every business conditions differ. The manufacturer who knows only one line will tell you his business "is different" and "is peculiar." The banker who daily strips each such business of its details and reduces it to its fundamentals with a few well chosen questions, will tell you that the principles underlying all are identical.

CHAPTER III

THE EXECUTIVE FUNCTION OF STATISTICS

A Financial Failure.—About ten years ago New York was the scene of a great taxicab mystery. Contrary to what you might imagine, the details were aired, not in the criminal courts, but in the courts of bankruptcy—for the case was one of financial failure. Until the mystery was unraveled there was plenty of unpleasant excitement for those involved. In order that the reader may the better understand this case, it may be well to review briefly the conditions that existed at the time it occurred. At that time automobiles had emerged only recently from the era in which every time you took a ride in one, you made a small bet with yourself as to whether you would come home in the auto or on foot. Street gamins still yelled "Get a horse," and no show was complete without a scene in which the comedian crawled under a motor and, after an explosion, was dragged out with a black eye. The taxicab business was in its infancy, and the infant mortality certainly was high! A company would be formed, would show satisfactory balance sheets for two or three years, pay generous dividends, and then fail. The worst of it was that no leaks could be detected, there were no signs of improper accounting methods, and the business in each case seemed to have been conducted carefully and honestly. Propositions that figured out

well on paper lived up to their promoters' expectations for two or three years—and then went to smash.

The solution of the mystery—like the end of all good detective stories—was so simple, when it was discovered, that no one could be found even to play the part of Dr. Watson and murmur "Marvelous" when the analyist discovered the culprit. The explanation was simply this—motor car styles were changing so rapidly at that time, that a car was completely out of date in three years. No one would ride in one three years old, and so the heaviest part of the taxicab companies' investment had to be renewed every three years. Any cars that didn't go out of style within that time were rattled to pieces beyond hope of repair by New York pavements. As a result, a certain taxicab company that had a hundred thousand dollars' worth of cars in 1904 had ten thousand dollars' worth of junk in 1907. The ninety thousand dollars' worth of loss—of which they were ignorant because new cars were bought gradually and companies were careful not to neglect repairs—took them into the bankruptcy court at the end of the three years. The man who had been called in to solve the mystery recommended a depreciation charge of thirty per cent. His recommendation was acted upon by that company, and afterwards by others, and since that time there have been fewer mysterious failures.

About four years ago a man who is president of half a dozen corporations told me with a great deal of pride that he had just begun to charge off deprecia-

tion. He had been doing business thirty years and had amassed nearly a million dollars, without even finding out that every building he had put up had, so to speak, ceased to exist at the end of twenty-five years. In a case of this sort the American spirit of the past would argue "He never knew what depreciation was, hey? But he made a million, didn't he? Well what's good enough for him is good enough for me!" That sort of argument may be what they used to call "pretty slick" in up-state New York, but belief in it can lead only to disaster in this day and age. Profits of thirty and forty per cent on the capital invested are a tning of the past, and our conservers of natural resources and our labor forces mean to keep them dead and buried. In those good old days a man could make enough profit so that seven or eight per cent, more or less, didn't matter. Now, that seven or eight per cent is the whole profit, and the corporation manager who doesn't guard every penny of it for his stockholders is thrown into the discard as a failure.

Not long ago the general manager of one of our largest Middle Western coal companies made an interesting remark to me concerning an announcement that had recently appeared in the daily papers. The owner of a chain of coal properties had been wrecked financially. The man, a tireless worker, had been a pioneer in the district, and had been astute enough in the early days of his career to secure some of the best coal lands in his state. "That man," said my friend, "has kept this market in a turmoil for thirty years—and at last he has reached the end of his

rope. He could always undersell his competitors because he never knew what it cost him to do business. He has been losing money steadily and mortgaging his property right and left for years. This is the end—and a simple cost system would have saved him."

In these three illustrations just cited you have the picture of a certain phase of an American industrial era which is passing—an era characterized by failure through ignorance and success through luck. Although American business has produced some of the finest examples of the corporation executive in the world, nevertheless there is good reason for Bradstreet's statement that more than ninety per cent of our business ventures fail. Our natural resources have made possible loose methods of doing business. Now we must trim ship and prepare to meet the storm of competition that will break upon the country in the next few years.

Antiquated Methods.—In the days when our grandfathers operated small factories in connection with the work on the farm, they needed no cost system to enable them to keep track of the work they and their hired men did each day. They had to be on hand, in any event, and whatever they could earn through the factory at odd times was "pure velvet," or at any rate could be reckoned in the same way as the proceeds from the corn crop or the apple crop were reckoned.

Later our fathers expanded the quarters for this department of the farm into a two-story building, hired a few more hands, and gradually built up a factory,

which was proudly pointed out to citizens from the nearby towns as the home of "one of our leading industries." Our fathers were brought up to honor father and mother, and they weren't sent to college to imbibe what they called "fancy notions." What was good enough for the "old man" was good enough for them. The period was one of conservatism and of faith in the old ways, and as long as communities were more or less isolated and there was only one factory in a community, ultra-conservative methods were eminently successful. Factories made money and reinvested the earnings.

A period of expansion followed. The country's population increased, but the factories increased faster than the people, and competition became unbearable. Consolidation naturally followed, until we now have hundreds of ten-million-dollar corporations turning out hundreds of tons of products every day. The cost system that grandfather used on the farm won't do, and the manufacturer who tries to make it do is following the road to the land of oblivion inhabited by the American Indian and the dodo.

Dislike of Elaborate Cost Systems.—One reason why our conservative manufacturers have hesitated to install elaborate cost systems is that they have an inherited dislike for the non-producer—and they consider each of the men who figure detailed costs a non-producer. In the olden days, any one of the boys who sat around on grandfather's farm was either urged to go west or else was made into a lawyer, a minister or a doctor. He wasn't popular on the farm unless he "took hold and helped." Consequently a good many

of us have inherited a sneaking feeling that the fellow who sits around in a white collar and pores over a big book of figures somehow isn't keeping his end up around a manufacturing plant, and we are prone to refer to his salary as "overhead expense" or as "burden on the productive labor," and our instinct hasn't been so much at fault in this matter as certain types of expert accountants would have us believe. There is no doubt that a good deal of money has been wasted, and is being wasted to-day, in preparing elaborate cost figures which the active executive either never looks at, or which he reviews only in such a perfunctory manner that he profits little from the consideration he gives them.

In some cases, it is true, cost figures, even when prepared very carefully and very accurately, from the accounting standpoint do positive harm in an organization. One old brick-maker, who was superintendent of a paving-brick plant, told me that all he wanted to know was how many brick he got out of the machine every day and how many men he had on the job—and that he didn't give a hoot in hades what those bookkeepers down in the office said. Later on I found he had good reason for his views. It seems that an ingenious cost clerk had devised an account which he called "in suspense," and every time the old fellow's cost of production went up he lopped off a few thousand dollars and stowed them away until a period of low costs occurred, when he took them down off the shelf, as it were, and ran them into the costs. In this way the cost clerk secured a beautifully even cost-showing which did not offend his

artistic eye, and when the geenral manager took the sheet out to the superintendent the latter could tell, of course, that the figures didn't reflect operating conditions at all. As a result this superintendent's contempt for "liars who figgered" was something abysmal.

Fundamental Principles of a Cost System.—There are certain fundamental principles that we must recognize in devising any cost system. In the first place, the expense of compiling cost figures is a direct burden on the business, and must be subtracted from the net profits. To prove their right to existence, therefore, costs must earn profit just as surely as do those departments known as the productive departments, where the raw materials are processed by direct labor.

There are three ways in which costs can justify their existence:

I. They can help the management—and the factory executive—to operate the manufacturing departments with the greatest possible economy.

II. They can help the management—and the sales department—to sell more efficiently by furnishing an incentive for higher prices and for specialization in the more profitable products.

III. They can assist the management in the determination of the company's financial and general policy.

In short, then, the costs must be arranged in such a form that they will function actively in assisting the management in the administration of the business.

When necessary they should go even further, and speak with sufficient insistence to force the management to make the correct decision when there is a choice of methods.

To manage a modern factory employing three or four hundred men is an intricate and difficult task. The superintendent needs all the help that can be given him. He should be able to look upon the general manager as his best friend—as a friend who can and will give him advice and assistance when he wants it, and who is able and willing to guide him back to the right path with the firm kindness of a father when he has gone astray.

The general manager is a busy man. It is, of course, impossible for him to be conversant with every detail of the business—and yet he must be ready to act—and act quickly and without hesitation—when the occasion demands. Furthermore, he must make right decisions fifty-one per cent of the time, or he is a failure and the business is a failure. Inasmuch as there are only twenty-four hours in the day, and since there is a limit to every general manager's physical endurance, the information that comes to him must be put through a screening-out process before it is submitted to him. It is his duty to see that what is important reaches him—and nothing else.

Application of the Principles.—An effective cost system is one that brings to the factory superintendent and to the general manager only the facts that each must know in order to do his work with the greatest effectiveness—no more and no less. The form in which the information reaches the executive

is relatively unimportant. It is just on account of weakness in this particular that the advocates of cost-keeping systems have received their second black eye. Our friend, the old-fashioned brick-maker, realized that if he knew every evening the number of brick his machines had turned out that day and how many men he had had at work, he could run his factory more efficiently than he could if he depended on elaborately detailed cost data prepared from two to six weeks after the brick were made, by an accountant who knew nothing about operating conditions at the factory.

The best expert accountant is one who has been a factory executive. If he has not had actual experience with manufacturing problems he is prone to prescribe elaborate forms which he delights to draw up with only a cursory thought for the bills that the manufacturer must pay for stationery and clerk hire. Moreover, he is likely to give no thought whatsoever to making the cost system help the harassed factory executive solve his problems. The trouble with too many cost systems is that such information as is designed to be of assistance in the operation of the factory reaches the executive when the occurrences recorded are lost in the dim past of ancient history—and the more elaborate the cost system the more antediluvian is the history.

The efficient cost system, furthermore, should be such as to bring to the executive the vital facts of operation in the exact order of their importance. If this rule is followed, the result will be that even if the general manager is overworked, he will be en-

abled to spend his time profitably in a consideration of the important facts; he will not be obliged to waste his time in wading through unimportant details.

The cost system must be so arranged, also, as to impress forcibly upon the management its message in regard to the administrative policy—factory, sales and financial. When anything is wrong the cost system should, as it were, shout that fact so loud that the trouble cannot be overlooked.

Finally, the system must not take up the time of the busy executive except when it is essential to the success of the business that he give his attention to costs. The rule implied in this statement involves what is known as the "exception principle." If it is practised, the result is an arrangement of the costs in such fashion that only a few figures come regularly before the management. The few that are selected, however, exactly reflect the efficiency of operation. The slightest fluctuation calls for an investigation—and when an investigation is necessary, reliable information must be available in the fullest detail.

To determine the effectiveness of a cost system, then, one should measure it according to the following standards:

1. Is it economical as regards labor and material?
2. Is it simple enough to be understood by all those who are to make use of it?
3. Does it truly reflect operating conditions?
4. Does it accentuate the matters of importance in the order of their importance?
5. Does it bring the facts to the executive promptly enough so that faults of operation may be avoided?

6. Are the facts brought to the executive with due regard for the value of his time?
7. Is sufficient insistence placed upon the facts to force the executive to the correct decision when decision is necessary?

If you can mark a cost system 100 per cent efficient according to these standards there can be no doubt whether the system is earning its right to existence as a factor in production by its active assistance in the creation of dividends for the stockholders of the corporation.

CHAPTER IV

THE COST SYSTEM, THE SOURCE OF RELIABLE STATISTICS

The Basis of Scientific Management.—In the three preceding chapters I have endeavored to present a bird's-eye view, as it were, of industrial conditions in this country to-day, and to make certain phases of the present situation clearer by tracing the development of our great corporations from their comparatively small beginnings. I have attempted to show, at the same time, how the difficulties of administration have increased for the executive in almost geometrical progression as the size of the organization has increased and as industrial processes have become more complex. Having shown, then, in a more or less general way the need for definite and effective methods of management which changed conditions have created, I shall now proceed to a description of specific methods that the progressive executive employs in order to meet these altered conditions successfully.

In order, however, that these methods may be the more clearly understood, let us consider briefly the scientific method—the source of what has come to be known as scientific management—and in regard to the movement itself let us note the relation of statistical control to the other elements of management.

Perhaps as clear and concise an explanation of the scientific method as can be found is the following statement, made by Edward D. Jones, Professor of Commerce and Industry at the University of Michigan:

The pure method of science is the original source of inspiration of scientific management. Very briefly and inadequately expressed, it is somewhat as follows:

1. The first step is to analyze a subject into parts, and to deal with the subject a part at a time.
2. The second step is to proceed with the collection of data in this analytical form, until it is certain that the record fully records the law of the subject, whatever that law may be; and further, until accidental errors and other variations due to chance are reduced to negligible or definitely calculable proportions.
3. Third, the data are to be so arranged that they will be brought to bear as fully and clearly as possible upon the object of the study.
4. Fourth, an inference is made, or a new relationship discovered.
5. The fifth and last step is to give to the new inference a thorough testing by comparing it with known facts, to ascertain whether it is truth or error. If the new inference stands the test, it is no longer considered a hypothesis, but a truth.

The scientific method, then, is the principle which underlies scientific management. Various engineers, of course, have different methods of applying the principle and have set forth their methods, each in the form which he believes is best calculated to explain his own application of the principle. These codes are necessarily somewhat vague because each particular business, even each particular department and operation must be studied separately and

that remedy must be applied which will insure the maximum operating efficiency of that operation, department and business, at all times. In the accomplishment of this object, there is brought to bear on the problem all the knowledge of the workman, the foreman, the superintendent, the manager and the engineer. The greater the knowledge of each, the more nearly perfect the final result. The engineer is not a critic but an epert in the art of organizing industrial forces for victory by applying the principle and its elaborations.

Elements of Scientific Management.—There is always considerable danger in attempting to reduce knowledge to hard and fast rules, since once the author has gone on record by committing his beliefs to writing, he feels bound to defend those beliefs, even as the loyal politician feels bound to defend his party's platform. Nevertheless, for the sake of clarity, it has seemed advisable in the present case to risk future biased judgment—and incidentally, perhaps, the criticism of the arm-chair type of industrial engineer, who is ever ready for a disputation as to the tenets of a creed—and to attempt a brief tabulation of the principal elements of what is known as scientific management. The following classification* will serve the purpose:

I—STANDARDIZATION of machinery, equipment and conditions.

II—ROUTING, to insure the product's being moved in the most economical manner with the fewest, shortest and safest movements possible.

*From "Scientific Industrial Efficiency" by Dwight T. Farnham.

III—Centralized Control, including:

1. Setting standards of accomplishment.
2. Scheduling—planning to attain these standards.
3. Dispatching—making sure, step by step, that the standards are attained.
4. Stores-and-material control—to integrate with the above, and so insure the presence of the right thing at the right time.
5. Release of executives from details of operation by means of a practice of the exception principle.

IV—Analytical Cost System.

1. Graphic comparison of all important operations.
2. The operation of the ratchet principle, which prevents the loss of an advantage once it is gained.
3. Immediate returns—on all important operations—which make possible the application of correctives in time to hold losses down to the minimum.

V—Waste Elimination. Application of the scientific method in the case of losses of every sort, which insures their reduction to the minimum.

VI—Staff Investigation of all problems of administration, sales, and manufacture.

1. The committee system.
2. Harmony meetings.
3. Development of specialists.
4. Expert counsel.

VII—Definite Management, as contrasted with casual methods of control and organization:

1. Exact and clearly stated limitations of line authority—which prevent both the conflict of orders, waste of energy through the efforts of any executive to encroach upon the preserves of another executive, and the various other inefficiencies of the feudal type of organization.

2. Functional foremanship, which combines staff specialization with line executive powers in the same individual or in different individuals, with such concert of action that the effect is equally effective in both staff and line activities.

VIII—Intensive Labor Development.

1. Labor-turnover reduction.
2. Organized employment.
3. Safety first.
4. Health insurance, hospital arrangements, etc.
5. Welfare work.
6. Profit-sharing.

IX—Analytical Time-Study. The scientific determination of exactly how much work should be turned out by each employee.

X—The Bonus Reward, which involves the payment of each worker—laborer, foreman, superintendent, salesman and manager—in exact proportion to what he accomplishes for the company.

XI—Written Instructions and Standards. The preservation in permanent form of all facts upon which decisions are based, as well as the filing of all decisions, either staff or line, reached by the executives and the experts of the company.

XII—Modern Business Ideals, which imply that supreme common sense which has regard for the highest business ethics, believes in the fair deal toward labor, competitors and customers, possesses a willingness to exchange ideas with others and an open mindedness toward new ideas and toward technical and expert counsel, which such ideals imply also a willingness to participate in personally, and to support, progressive movements of real merit, and to practise as far as possible what has been characterized as the "golden rule in business."

This tabulation outlines, though inadequately, the principles subscribed to by the modern executive who desires to replace with "definite management" the casual methods of control and organization that served the needs of the old-time manufacturer when he set up a stave mill or a blanket factory on the corner of the farm nearest the village. Most of the particular divisions of management under the scientific method which I shall endeavor to make clear in the following pages, will be found under Section IV of the classification just given. I shall touch upon certain matters that appear under Sections III, V, VI and VII, and I shall refer, also, from time to time to other phases of the subject, since this discussion concerns management, and modern management reaches all sections of a business.

Danger of Adopting System Blindly.—It is no simple task to select a cost system which, at a minimum expense for compilation, will furnish the executive with the data that will make it possible for him to conduct the business in the most effective way. A man who comes into executive control in one of our large industrial plants generally is born to a cost system, or acquires one, or, worst of all, has one thrust upon him because, perhaps, some influential director has the fixed idea that statistical work represents "useless overhead."

The inherited cost system can usually be remodeled, in time, if sufficient patience be exercised, provided those in control are open-minded enough to recognize the deficiencies of such a system. I have known cases, however, in which ultra-conservative

directors insisted on retaining the old system almost indefinitely in addition to the new, simply because they suspected the new manager of trying to make a showing by manipulating the books instead of concentrating on the factory, or because they were sure they understood the old system, but found the new one confusing. Fortunately this sort of opposition usually wears away gradually, especially if the executive realizes—as most good managers do—that the larger part of his work with his directors must be of an educational nature. The man who can get his board out of the frame of mind in which they regard the business merely as a means of producing dividends and can fire them with an enthusiasm for the romance that lies in industry, the struggle for existence, the pursuit of the ideal product, the lust of the battle with competitors and, finally, the provision of steady, remunerative employment for hundreds of loyal co-laborers—such a man need not doubt that he will eventually carry his point when he asks for an appropriation of funds with which to install advanced methods of any sort.

Such an executive belongs in the second class described above, which consists of those who acquire cost systems. I do not propose to discuss in this connection the merits of the various kinds of cost systems and accounting methods, or to treat such questions as depreciation, sinking funds to distribute repairs, extraordinary repairs and the charging of interest on the investment. These problems are ably covered in another part of this Course. I do intend, however, to give an outline of a cost system which

has been successfully used, for the sake of clarity and in order that it may serve as a framework for the statements which will follow in regard to satistical control for the executive.

Dispatch Board Gets Results.—In the first place, a cost system should be flexible—like the "great hydraulic rams, which at the will of the operator will crack a nut wthout injuring the kernel, or which will reduce to powder a massive ingot of steel!" The authors of our boyhood used to describe them in all the enthusiasm of their innocence, in the volumes which haunted the shelves back of the organ in the village Sunday school. In other words, a cost system should furnish the executive the vital information all the time; it should furnish him, when necessary, all the information to the last detail.

For securing the desired end those systems which use a triplicate time or service card* are perhaps the most effective and, at the same time, the simplest. In accordance with such systems, the worker, when he begins a job, is given a ticket that fully describes from a cost standpoint the work he is to do. When the ticket, upon which is marked the time when the work is started, is made out by the clerk, two sheets of carbon are used, so that all the information on the first ticket appears also on the second and third sheets. While the job is in progress, the workman always holds the first ticket, the second and third sheets (and carbons) are placed on a rack, Figure 1, which is known by various titles. This rack I shall call the dispatch board (borrowing a term from the

* See Figure 4 in Chapter V.

FIG. 1. TYPICAL DISPATCH BOARD AND DISPATCH CLERK'S DESK
The employees call at this window for their service cards which appear on the boards.

Railroad). Any one who understands the system can check up the honesty of all concerned at any time, simply by comparing the ticket held by any workman with the duplicate on the Dispatch Board. Moreover, the department foreman can tell by a glance at the dispatch board just how many men are working and exactly what they are doing. There are also certain graphic features of this system which will be described elsewhere.

When the workman has completed his job he returns his ticket to the clerk, who fastens the second and third tickets to it and marks in the time when the work is completed. At the same time the workman is given a new ticket, which has been prepared beforehand under the direction of those who plan his work for him, and who comprise what is usually known as the planning department.

The three tickets are now separated. Each one of them contains complete information—the amount of time the work has consumed, the rate of pay, the name of the employee and of the department for which he did the job, a brief description of the machine and of the material he used, and any other essential data. The first ticket, which the workman held, becomes the timekeeper's source of information. From it the latter enters upon the payroll the hours worked and ultimately the amount of money due. He then files the ticket according to the man's number. If an employee ever questions the justice of his remuneration, the timekeeper is in a position to show him the actual ticket he held while he was doing the work.

The second ticket, which also contains complete information, goes to the cost department, where it is filed under the item under which the money, the expenditure of which it represents, will eventually appear on the monthly cost sheet.

The third ticket also goes to the cost department. It is filed in a special manner, which varies with the kind of business and with the particular investigation that is being made. It may be used in the determination of job costs when the monthly costs are assembled according to departments, or vice versa—or for any special purpose designated by the management.

Assembling the Costs.—The principal advantage of the whole system is that the original record becomes the final record. Furthermore unit costs are determined by sorting the cards—"by playing solitaire with them," as one clerk expressed it. In other words, it is not necessary to copy a lot of figures in order to assemble totals, and thus run the risk of making a number of mistakes. The system makes all work of recording easier, since it renders it almost mechanical. Once the tickets are stacked together, the cost of the work can be found by taking off on an adding machine the total of the various job tickets.

Each day the second tickets, original and duplicate, are sorted according to product and department if the particular business falls in the continuous-productive class, or in any other manner the business may require, and then their totals are taken down on what is usually called the distribution sheet. This sheet is prepared in various ways. Usually there is at the left

DAILY LABOR DISTRIBUTION

ACCOUNT	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTALS
L-D-1 Handling Raw Materials																	
Ch.																	
G																	
B																	
El.																	
Handling Raw Materials-Totals																	
L-D-2 Grinding																	
Mix 1																	
" 2																	
" 3																	
Grinding - Totals																	
L-D-3 Tempering																	
Mix 1																	
" 2																	
" 3																	
Tempering - Totals																	
L-D-4 Moulding																	
Mix 1																	
" 2																	
" 3																	
Moulding - Totals																	
L-D-5 Drying																	
Mix 1																	
" 2																	
" 3																	
Drying - Totals																	
L-D-6 Setting																	
Mix 1																	
" 2																	
" 3																	
Setting - Totals																	
L-D-7 Burning																	
Mix 1																	
" 2																	
" 3																	
Burning - Totals																	
L-D-8 Drawing																	
Mix 1																	
" 2																	
" 3																	
Drawing - Totals																	
L-D-9 Rehandling																	
Mix 1																	
" 2																	
" 3																	
Rehandling - Totals																	
TOTAL DIRECT LABOR																	
L-P-1 Engineers, Firemen, Etc.																	
L-P-2 Maint. Power Plant Equip.																	
L-P-3 Extraordinary P.P. Repairs																	

FIG. 2. DAILY DISTRIBUTION SHEET

a list of departments under which are shown the products of each department, and opposite, under the date, spaces are left in which entries can be made of the amount of money spent on production in each department. As the amount spent on each product is ascertained from the tickets, it is entered under the date. The total amount spent for labor on any one date should equal the total of the payroll amount for that date. This method makes it possible to check the labor cost daily by the payroll, and vice versa—a system which is likely to save the burning of much midnight oil at the end of the month, and which usually means the completion of the costs and the payrolls on the date set.

The costs are assembled from the daily-distribution sheet, Figure 2. The usual monthly cost sheet, Figure 3, contains, at the left, the same list of departments as the distribution sheet. The names of the products are, however, carried as column headings to the spaces at the right of the departments and under each such column heading appears the following information:

(a) The total expenditure for the month—known as the monthly expense.

(b) The total expenditure for the year, including the month in question—known as the cumulative expense.

(c) The cost per unit for the month (part "a," divided by the units produced in the department that month).

(d) The cost per unit for the year (part "b," divided by the units produced in the department that year) known as the cumulative average.

This system enables the executive to judge whether

MONTHLY COST SHEET																	
		Total Products all Factories				Total Products Factory No. 1				Product B							
	Ground Tons																
	Made Tons																
	Set Tons																
	Drawn Tons																
	Shipped Tons																
Account No.	Department	For the Month		Year to Date		For the Month		Year to Date		For the Month				Year to Date		For the Month	
		Amount	Per Ton	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton	Std.	%	Amount	Per Ton	Amount	Per Ton
LABOR DIRECT																	
L-D-1	Handling																
L-D-2	Grinding																
L-D-3	Tempering																
L-D-4	Moulding																
L-D-5	Drying																
L-D-6	Setting																
L-D-7	Burning																
L-D-8	Drawing																
L-D-9	Rehdg & Haul.																
L-D-10																	
L-D-0	Total L-D																
LABOR POWER																	
L-P-1	Engineers, etc.																
L-P-2	Maint. Power																
L-P-3	Extraord. Rep.																
L-P-4																	
L-P-0	Total L.P.																
LABOR MAINTENANCE																	
L-M-1	Foot. Equip.																
L-M-2	Kilns, Flues																
L-M-3	Driers																
L-M-4	Wagons, Trucks																
L-M-5	Dies & Pat.																
L-M-6	Extraord. Rep.																
L-M-7																	
L-M-0	Total L.M.																
LABOR SUPERVISION																	
L-S-1	Supervision																
L-S-2	Factory Office																

FIG. 3. MONTHLY COST SHEET

the cost for the month is above or below the average, and to tell just how much money was expended in each department for each product. At the same time it furnishes statistical information in sufficient detail to allow of the prompt and easy preparation of the various charts and graphs which are described later.

The material costs are similarly assembled. Each article drawn from the stores is recorded on a requisition, which is later sorted to department and product, and through the medium of a material distribution sheet eventually appears on the monthly cost sheet, having followed much the same course as the labor costs. The principle to be kept firmly in mind in devising a stores system is the one so frequently enunciated by that erstwhile occupant of the pages of our comic weeklies—the Chinese laundryman. It must always and forever be a case of "no checkee, no washee," even though the heavens fall. If any one is allowed to remove material or supplies from the store house without turning in his "checkee" in the form of a requisition, the whole system goes to pieces. I have usually found that the best attitude of mind to assume in regard to the stores system is that of a banker entering a new territory. He may establish a branch bank here and there, but there must always be a branch bank manager—some one responsible for the withdrawal of money from any bank—and the branch manager must be made to understand that he shall pay out not one cent over the counter without a check, signed by a responsible party. To draw the parallel, the manufacturer may have a lumber yard, or a casting en-

closure, to save rehandling of materials, but he must always have some one in charge whom he holds responsible for the withdrawal of any material; and he must impress upon the manager or foreman the importance of his not allowing any one to withdraw material without first submitting a requisition signed by a responsible person.

Costs and Operative Efficiency.—There is another important point in connection with cost-keeping which is often overlooked—namely, that the kind of costs which lead to the most efficient factory operation are often quite different from the kind upon which it is safe to base selling prices. When the executive is figuring a sales price that will give him a profit, he must divide the total expense representing all the money spent for a considerable period by the total number of completed saleable units produced, in order to determine the unit cost. This procedure provides for a consideration of the wastage in each department, which is an important matter since the firm sells only the complete and perfect product.

The method may be illustrated by the following example—the case of a brick factory. This procedure applies equally well to any similar line of manufacture which incurs manufacturing losses in connection with material in the semi-processed as well as in the three-quarter finished state.

The difference in cost between the two methods amounts to $2 per piece. For the sake of emphasis losses are exaggerated in the example, but even if losses are below the average, sales made based on costs and compiled under Method A may result in

METHOD A (DEPARTMENTAL)

Operation	Pieces Processed	Expense	Cost per Piece
1. Forming and Drying	100	$100.00	
2. Loss in Drying	50		
3. Net Departmental Output	50		$2.00
4. Burning	50	$100.00	
5. Loss in Burning	25		
6. Net Departmental Output	25		4.00
7. Total Cost per Saleable Piece (based on Individual Departmental Costs)			$6.00

METHOD B (SALES)

Operation	Pieces Processed	Expense	Cost per Piece
1. Forming and Drying	100	$100.00	
2. Assume loss (in drying)	50		
3. Burning	50	100.00	
4. Assume loss (in burning)	25		
5. Total Expense		$200.00	
6. Total Number Saleable Pieces.	25		
7. Total Cost per Saleable Piece			$8.00

actual profits much lower than those shown by the monthly balance sheets. Not long ago I had occasion to investigate this very problem for a large concern, and I found that even though an allowance was made for process losses the company's state-

ments for the year showed profits over $12,000 in excess of those actually earned. The result of such undiscovered losses when they continue for a period of years can readily be imagined.

To repeat, then, sales prices should be fixed by adding a profit to a cost which is the quotient of the division of the total amount expended during a period of months by the saleable units produced for that period. Thus:

$$\frac{\text{Cumulative Average Total Manufacturing Expense}}{\text{Cumulative Average Total Saleable Units Produced}} \quad \text{Safe Cost for Sales Base}$$

It goes without saying that in the case of irregular output, when a much greater amount of product was in process of manufacture at the beginning of the period than at the end, allowance should, of course, be made.

Method B is of no use to the executive for the purpose of statistical control, however, since the final cost figure is the only one which appears. If the efficiency of the factory is to be increased, much greater detail is required. Under such circumstances Method A, which furnishes departmental costs, must be adopted. When this method is used the total cost is pracically of no use as a sales base. The costs in each department are, however, accurate. It is important that the executive, in the case of the brick factory, keep continually informed concerning the cost of forming and drying each unit, in order we will say, that he may praise or chide the workers and the superintendent according to their respective performances. When scientific management is employed, the bonuses, of course, reward each worker and each su-

perintendent exactly in proportion to his accomplishment as to quantity, quality and cost of production.

It is, however, no concern of the forming and drying crew of the brick factory if the men who truck to the kilns later on smash or destroy every brick. Their job is to form and dry the product, and their reward—be it praise or bonus—must be based upon their own performance of their own duties, not on what happens in connection with jobs which precede or follow their own, and over which they have no control. The same thing holds true in the case of the burning crew. Their job is so to perform their duties that the maximum amount of the product contained in the kilns shall come forth perfect, at the lowest cost. The executive must know exactly how efficiently the burners are performing their duties if he is to reward with any show of justice.

Briefly, then, if costs are to be of value from the standpoint of the executive, they must be figured as if each machine and each department were a little factory all by itself, and even if each be operated by a single man, the costs must show what the expense of production is and what quality of product is turned out.

Efficiency, Production Costs, and Profits.—The efficiency with which the factory is operated is the principal factor in production costs and in profits over which the executive has the greatest control. The best salesman in the world can overcome only a moderate price differential by exerting the force of his personality. A brief analysis of the cost of production in an imaginary case will make this statement

clear. Let us take for example a product that has the commonest five variables, all of which influence cost: (1) shape, (2) material mixture, (3) process, (4) quantity, and (5) efficiency of manufacture.

The first of these, shape, is largely determined by the customer. He knows what he wants—whether in wood, steel, or composition—and that is what he orders. The manufacturer strives to please him, regardless of the fact that it is easier and cheaper to manufacture articles in some shapes than in others. The executive can only bow to his customer's will and follow the blueprint furnished.

The second variable, mix, is also controlled by the customer consciously, as when a certain wood is ordered for a door, or when a certain proportion of various ingredients is definitely named in an order for a casting; or unconsciously, as when the particular use to which a tool or a refractory is to be put, is specified. In this case the manufacturer, out of regard for his reputation and the future prosperity of his firm, must furnish a mix that will stand up under the treatment it is to receive—regardless of the fact that he could use some other mix more cheaply. The executive has little control over this factor of cost. If he wishes to make a success of his business he must be guided by the reasonable demands of customers.

The third variable, process, is determined partly by the customer, and partly by the executive in his desire to uphold the reputation of his house, as in the case of mix.

The fourth variable, quantity, while nominally controlled by the sales department—since their activities

are the most closely related to the disposal of the product—in reality depends fundamentally upon 1, 2 and 3 (shape, mix, and process) in so far as they represent satisfied customers and quality of product, and upon the cost of production, which determines the selling price.

The fifth variable, efficiency of manufacture, is in the hands of the executive. This, if he is worthy of the name of executive he can control. As a matter of fact, the success of the business is dependent upon his ability to control efficiency. For that reason the first, the last and the eternal duty of the statistical department is to keep the executive continually informed concerning the efficiency of operation. And the ultimate success of the executive depends upon his wisdom in selecting a cost system and upon the use he makes of the information which it furnishes him.

CHAPTER V

THE COST SYSTEM—CONTINUED

Job-Cost and Continuous-Production Systems.—In order to make clearer the statements in the preceding chapter I have included in this chapter certain special illustrations which concern what the Federal Trade Commission has termed the continuous-production system in contrast to the job-cost system. It is interesting to note in this connection the following statement of the Commission:

> There are, generally speaking, but two distinct methods of manufacture. Each requires a cost system a little different in detail, but identical in fundamental principles. The first of these is used in a business where every order is a separate article of manufacture, very often made to order, and where the selling price is fixed before work is started; and the second is used in a business where the output consists of one or more articles which are being continuously produced. For convenience we will designate the cost systems applicable to each as the "Job Cost System" and the "Continuous Production System."

Mnemonic System's Special Advantages.—No discussion of cost systems would be complete which did not emphasize the importance of mnemonic symbols. Their value cannot be overestimated. The use of these symbols carries with it the following advantages:

1. It decreases the liability of error in the records, as well as the possibility of any dishonesty on the

IMPERIAL MILLING COMPANY — LABOR SERVICE CARD — FORM 520 A

NAME EMPLOYEE					MAN NO.	DEPT. NO.	DATE
James Brown					2313	3	1-13-17
STARTED	Continued	FINISHED	WITH NO.	MACH. NO.	ORDER NO.	OPER. NO.	ACCOUNT NO.
				6	Z 2816	A	L-D-1

DELAY AND CAUSE	STD. TIME
OPERATION	TIME FINISHED 5-0
	TIME STARTED 0-0
	TIME ELAPSED 5-0
	RATE
	WAGES
	BURDEN
	TOTAL

QUANTITY	PRODUCT	PCS DONE	WT. DONE
10	ch		

FIG. 4. SERVICE CARD

This form is in triplicate. For convenience the upper is tinted blue, the second pink and the third, white.

part of a workman. The symbol appears on the workman's job ticket—which is always in his possession—and accompanies the dollar, as it were, which is paid out to him in the form of wages for that particular job, in all its journey through the books and records of the company. Thus, when James Brown, No. 2313, begins work shoveling (Operation No. A) raw material (Product Ch) in the handling department (Account No. 1) in factory No. 3 (Department No. 3), thereby performing direct labor (Account No. L-D), the Dispatch Clerk writes—as shown in Figure 4—the following name and symbols in their proper places on the service card:

James Brown, 2313, A, Ch, 3, L-D-1.

Later on, these symbols indicate to the timekeeper

where to enter the number of hours (5) that James Brown (No. 2313) worked, and show the cost clerk just where to enter the amount of money expended upon that work on the daily ditsribution-sheet, which has on it a space in which is to be recorded the total amount of money spent during the day on "Ch" in Department 3 for L-D-1.

Still later, the bookkeeper enters, under Account L-D-1, or under Control Account L-D, James Brown's "dollar," together with those of dozens of other workers. Throughout all its devious wanderings, however, that very dollar can always be traced back to James Brown, and the fact can be established that it was paid him for shoveling off just so much "Ch" on the morning of January 13, 1917.

2. The use of mnemonic symbols also materially decreases the amount of work required of every one who has anything to do with recording James Brown's activities. This fact would become apparent immediately to any person who should compare the length of time it takes to describe exactly the work that James Brown did (described immediately above), with the time it takes to write out the words for which the symbols shown on the service card stand. Incidentally, it is entirely probable that some of James Brown's time is saved by this method—especially, considering that when the more cumbersome long hand method is used he may stop work while the Dispatch Clerk makes out his ticket. A certain amount of time is also saved by having definite headings which are agreed upon for current use. If the mnemonic symbols are not used, each clerk is likely

to describe the same operation a little differently each time he performs it. Moreover, each clerk who records operations makes his own personal interpretation of a different expression each time—for example, one clerk might write "unloading coal for power," another "unloading boiler coal," another "shoveling coal at boiler house," and so on. All mean the same thing, and could be expressed much more quickly and with less chance of misunderstanding by writing L-P-1-A.

3. The greatest advantage of mnemonic symbols, perhaps, is that they are conducive to extreme flexibility in the compilation of costs. When they are used with the service card it is possible to assemble manufacturing costs under the three main headings of labor, material and charges. In other words, just three principal headings are sufficient for the recording of either the detailed cost of the smallest operation in the most obscure department, or the total cost of all operations. The executive can assemble just as much detail or just as little as he considers desirable. Information concerning the cost of all work is always at his command; consequently, expenditure for superfluous clerical work is never necessary. Thus complete statistics for control can be obtained at the least possible expense.

The task of working out the series of symbols for any individual business furnishes an opportunity for the exercise of considerable ingenuity. Besides the question of completeness, there are several points to be considered in connection with any mnemonic system—for example the relative speed with which different

kinds of symbols can be written, and the ease with which they can be remembered. A certain group of engineers insist very rigidly upon the use of letters and combinations of letters—rather than figures—and advocate their use throughout the business as a sort of shorthand. Letter symbols are generally more easily remembered than figures, since they are based upon the psychological principle of the association of ideas. For instance, often a symbol consists of the first, or of the first and the second letter of the word that it indicates.

Figures, however, possess certain distinct advantages for mnemonic purposes. They can be written from forty to fifty per cent faster than letters. When they are used, once operations are listed, the insertion of new operations is simpler and quicker than when letters are employed. A designation like L-1-3-4 is neater than one composed of letters. Moreover, it can be culled from among a list of hundreds of accounts rather more quickly by the novice than a symbol such as SYSE-EFUL-GKE.

Combination Mnemonic and Numerical System.—It will be noted in the following pages that I have adopted a combination of the two systems in an endeavor to secure both the advantages of the association of ideas which the letter system furnishes, and the speed and flexibility that are characteristic of the number system.

The service card, completely filled out, is shown in Figure 4, page 59. Upon this card the following data are entered, each item in its proper place:

(1) The Account Number—(Ac.N.)—as shown by the list of accounts.

(2) The Department Number—(Dp.N)—as shown by the enclosed list, which includes three factories together with their subsidiary departments.

(3) The Sub-Department Number—(S.Dp.N)—the third figure of the account number (i.e., Grinding Dept.).

(4) The Operation Number—(Op.N.)—(i.e., Shoveling).

(5) The Product or Material—(P. or M.).

(6) Certain other information, which the card itself renders evident.

The three copies of the card are made out with carbons and the cards are filed as follows:

1. To man number—for the payroll.
2. To department number—for the compilation of the departmentalized costs.
3. Specially—as directed for the compilation of job costs in certain departments; for the determination of cost of special products or special processes; and for all other cost determinations of a special nature.

I have prepared the following operating accounts, to illustrate the classification of all expenses incurred in the operation of a plant, under headings which will give the most desirable information, and which will lend themselves most readily to standardization.

All expenses are classified under the following primary captions:

1. Labor. (L.)
2. Material. (M.)

3. Charges. (C.)
4. Administration. (A.)
5. Sales. (S.)
6. General. (G.)

The first three of these are in turn subdivided into secondary captions:

1. Direct Expense. (-D.)
2. Power Expense. (-P.)
3. Maintenance Expense. (-M.)
4. Supervision Expense. (-S.)
5. Rent Expense. (-R.)

The secondary captions furnish a means of comparing each month or at any other desired interval, the five items that most clearly show the tendencies toward efficiency or inefficiency in operation.

Finally provision is made for the detailed classification of all labor, material, and fixed charge expenses, in a clearly defined logical set of accounts designed to show the following items: The wages of each man for every tenth of an hour of the day; the cost of all material used, and the purposes for which it is used; and the distribution of all fixed charges.

From these accounts a manufacturing statement is to be made up each month which shall not only show plainly where every dollar expended has gone, but which shall indicate also just how effectively every dollar has been used. The value of such information cannot be overestimated, since it forms the basis of those methods of management which secure the greatest ultimate return upon the capital invested in the business.

CLASSIFICATION OF ACCOUNTS

DIAGRAM INDEX

1. Labor—(L).
    - Direct—(D).
    - Power—(P).
    - Maintenance—(M).
    - Supervision—(S).
    - Rent—(R).

2. Material—(M).
    - Direct—(D).
    - Power—(P).
    - Maintenance—(M).
    - Supervision—(S).
    - Rent—(R).

3. Charges—(C).
    - Direct—(D).
    - Power—(P).
    - Maintenance—(M).
    - Supervision—(S).
    - Rent—(R).

4. Administration—(A).

5. Sales—(S-)

6. General—(G-).

7. Assets—(T-).
    - Fixed—(F).
    - Current—(C).

8. Liabilities—(E-).
    - Fixed—(F).
    - Current—(C).

CLASSIFICATION OF ACCOUNTS

FACTORY ACCOUNTS: (Note: Enter under "Account Number" on Service Card.)

1—*LABOR*—(L)

L-D-0 *Direct* Labor Total.

- L-D-1 Handling—Railroad delivery to raw storage at mills.
- L-D-2 Grinding—Raw storage to ground storage.
- L-D-3 Mixing—Ground storage to delivery chute.
- L-D-4 Moulding—Delivery chute to driers.
- L-D-5 Drying—Care in driers.
- L-D-6 Setting in kilns—From driers to kilns.
- L-D-7 Burning—Burners, firemen, coal and ash handlers, daubers, etc.
- L-D-8 Drawing—From kilns to cars or yard.
- L-D-9 Rehandling and hauling—From yard to cars, to city, etc.

L-P-0 *Power* Labor Total.

- L-P-1 Wages—Engineers, firemen and oilers, coal and ash handlers.
- L-P-2 Maintaining Power Plant—Heat, light and main transmission — (Expense Order-Number, Reserve Account).*
- L-P-3 Extraordinary repairs to power plant—(Expense Order-Number, Reserve Account).
- L-P-4

L-M-0 *Maintenance* Labor Total.

- L-M-1 Factory equipment—Machinery, tools, etc. (Expense Order-Number, Reserve Account).
- L-M-2 Kilns, stacks and flues—(Expense Order-Number, Reserve Account.)
- L-M-3 Driers—(Expense Order-Number, Reserve Account.)

* "Expense Order-Number" indicates that the number of the order authorizing the work should be written on the Service Card. "Reserve Account" indicates that the charge is spread out over the year instead of all being charged against a single month's operation.

L-M-4 Motors, wagons and trailers—(Expense Order-Number, Reserve Account.)
L-M-5 Dies, moulds and patterns—(Expense Order-Number, Reserve Account.)
L-M-6 Extraordinary repairs—(Expense Order-Number, Reserve Account.)
L-M-7

(Note: Use L-T, etc., for Construction Expense.)

L-S-0 *Supervision* Labor Total.

L-S-1 Superintendents and foremen.
L-S-2 Factory office.
L-S-3 Bonus.
L-S-4 New moulds.
L-S-5 Garage and stable care and supervision.

L-R-0 *Rent* Labor Total.

L-R-1 Janitors and watchmen—(Expense Order-Number, Reserve Account).
L-R-2 Upkeep of buildings, yards—(Expense Order-Number, Reserve Account).
L-R-3 Extraordinary repairs—(Expense Order-Number, Reserve Account).
L-R-4

2—*MATERIAL*—(M)

M-D-0 *Direct* Material Total.

When semi-processed use condition symbols:—

M-D- 1	B	
M-D- 2	Ch	Ce—
M-D- 3	F	Ht—
M-D- 4	G	K —
M-D- 5	L	R —
M-D- 6	Sa	Re—
M-D- 7	Sh	S —
M-D- 8	V	W —
M-D-10	Sal	
M-D- 9		

M-P-0 *Power* Material Total.

M-P-1 Coal for power, light and heat.
M-P-2 Maintaining power plant, heat, light, main transmission—(Expense Order-Number, Reserve Account).
M-P-3 Extraordinary repairs to power plant—(Expense Order-Number, Reserve Account).
M-P-4 Purchased power, light.
M-P-5 Purchased water.
M-P-6 Supplies.
M-P-7

M-M-0 *Maintenance* Material Total.

M-M-1 Factory equipment—Machinery, tools, etc.—(Expense Order-Number, Reserve Account).
M-M-2 Kilns, stacks and flues—(Expense Order-Number, Reserve Account).
M-M-3 Driers—(Expense Order-Number, Reserve Account).
M-M-4 Motors, wagons and trailers—(Expense Order-Number, Reserve Account).
M-M-5 Dies, moulds and patterns (Expense Order-Number, Reserve Account).
M-M-6 Extraordinary repairs—(Expense Order-Number, Reserve Account).
M-M-7

M-S-0 *Supply* Material Total.

M-S-1 Superintendents, foremen.
M-S-2 Factory office.
M-S-3 Kiln coal.
M-S-4 New moulds.
M-S-5 Packing materials.
M-S-6 Setting sand.
M-S-7 Miscellaneous indirect.
M-S-8

M-R-0 *Rent* Material Total.

M-R-1 Janitors and watchmen.
M-R-2 Upkeep of buildings and yards—(Expense Order-Number, Reserve Account).
M-R-3 Extraordinary repairs to buildings and yards—(Expense Order-Number, Reserve Account).
M-R-4

3—*CHARGES*—(C) Distributed according to a carefully determined pro-rating chart.)

C-D-0 *Direct* Charge Total.

C-D-1 Insurance—On life, health, etc., and on productive equipment.
C-D-2 Depreciation productive equipment.
C-D-3 Welfare work.
C-D-4 Interest productive equipment.
C-D-5

C-P-0 *Power* Charge Total.

C-P-1 Insurance—Boiler, etc.
C-P-2 Depreciation power plant—(Subdivide with Operation Numbers).
C-P-3 Interest on power plant.
C-P-4

C-M-0 *Maintenance* Charge Total.

C-M-1 Insurance—Nonproductive equipment.
C-M-2 Depreciation—Nonproductive equipment, Subdivide with Operation Nos. into N. P. Machinery, Kilns, etc.
C-M-3 Interest on nonproductive equipment.
C-M-4

C-S-0 *Supervision* Charge Total.

C-S-1 Insurance—Liability factory office.
C-S-2 Depreciation factory, office furniture and fixtures.
C-S-3 Interest on factory, office furniture and fixture.
C-S-4

C-R-0 *Rent* Charge Total.

- C-R-1 Insurance—Fire and tornado (buildings or yard).
- C-R-2 Depreciation buildings.
- C-R-3 Taxes.
- C-R-4 Interest on buildings.
- C-R-5

General Accounts.

4—*ADMINISTRATION*—(A)

5—*SALES*—(S)

6—*GENERAL*—(G)

7—*ASSETS*—(T)

- T-F-0 Fixed Assets Total.
- T-C-0 Current Assets Total.

8—*LIABILITIES*—(E)

- E-F-0 Fixed Liabilities Total.
- E-C-0 Current Liabilities Total.

Department Numbers—(DN)

(Note—Enter under "Dept. No." on Service Card.)

1—Factory Number 1.
2—Factory Number 2.
3—Factory Number 3.
Bd—Burning Dispatch Office.
Bs—Blacksmith Shop.
Cs—Carpenter Shop.
Fd—Factory Dispatch Office.
Fo—Factory Office.
Ga—Garage.
Ms—Machine Shop.
St—Stable.
Sd—Stoker Department.
Sr—Store Room.
PP—Power Plant.

Important Broad Principles, Not Details.—A separate book could be written for each type of business to which such a system could be adapted. I do not wish to do more at this time, than to give an exposition of the system merely in sufficient detail to make clear the statements in the chapters that follow. I do wish, however, to emphasize this point above all others—that irrespective of whether the factory is of the continuous-production type or of the job-cost type, the cost system should be the same in principle. An example of the first type is the flour mill, where the raw material in the form of wheat is operated upon equally by each department and comes out in the final form of flour. The machine shop that does repair work for the neighborhood is an example of the second type. Here different kinds of work are done by different machines on different jobs in different series of departments. To be sure, what is most important in the cost system of one type of factory may be of minor importance in that of the other. Nevertheless, all the elements of the effective cost system must be present in both cases, although they will be differently accentuated.

A cost system must, first of all, be of the common-sense variety. It is the broad principles of the system—not the details—that count. Accountants will sometimes argue for hours as to just how a charge should be made. Whole books have been written on depreciation, and the American Society of Mechanical Engineers devotes a considerable portion of its annual meeting to discussions of the valuation of industrial properties. It is very easy, when selecting and in-

stalling a cost system, to digress into discussions as endless as the controversies of the ecclesiastics of the tenth and eleventh centuries concerning how many angels could congregate upon the point of a needle. It is generally safest to avoid harrowing and fruitless argument by admitting, like Sir Roger de Coverly, that "there is much to be said on both sides." A debate does not help progress in the installation of a system. The broad principles should be maintained always. The details must be settled by compromise, or little will be accomplished.

To summarize, the ideal cost system is the kind which, with the fewest and simplest printed forms, furnishes the executive with exactly the statistics he must have to maintain the business at its highest efficiency with the least possible expenditure of labor. When operating conditions are normal, it must consume only as much of his time as he need give to comprehend quickly the true status of affairs, but in time of emergency it must require him to give to the crisis sufficient time and attention to insure a successful issue. That is, the ideal cost system is flexible. It furnishes, at all times, sufficient detail to indicate the trend of the business, and when necessary places all the facts before the investigating executive in the shortest possible time.

CHAPTER VI

THE PERSONAL EFFICIENCY OF THE EXECUTIVE

The Inefficient Executive.—H. L. Gantt, who is in a position to speak on the subject with as great authority as any man in the country, has of late had considerable to say in regard to the inefficiency of our industrial executives. In an article which appeared in The Engineering Magazine a few years ago he makes the following statement:

> So far, the training of executives in democratic countries has been left largely to chance, and in few cases have the principles by which successful executives must be guided been even vaguely comprehended.

Anyone who has had an opportunity to study the methods of even three or four executives cannot help noticing that no two of them handle their jobs in the same way. In most cases the men in charge of our corporations "get away with it" by means of a strong personality and native ability. Because they have had to teach themselves, they have picked up numerous bad habits with the good ones that they have acquired. And in a good many cases they have reached their eminence only by sheer aggressiveness, will-power and ability in corporation politics.

Bernard Shaw once described the typical successful American business man as one who has an appear-

ance of "being able to make himself infinitely disagreeable." Some executives are able to rule their subordinates simply because they have carefully cultivated an appearance of being just about to explode with wrath. A number of years ago the papers were running stories of a certain director's meeting at which a great railroad king downed all opposition to his plans by beating on the table and yelling "Wow, wow, wow!" until his opponents gave up in despair.

I have known of several instances in which an executive has gained his point by cleverly acting as if he were in a towering rage when, as a matter of fact, he was absolutely cool. Men of the bargaining type of mind often resort to such tricks. "Tip over the apple cart—perhaps you can grab something in the mix-up," seems to be their theory.

Unfortunately the executive type of mind seldom possesses more than ordinary analytical ability. The type of mind designed to force results is not usually the type which enjoys abstract thought. "You can't meet situations until they arise," one man protested when he was being urged to lay out a broad policy of action. And he believed it. He had no imagination with which to visualize the future in the light of the present. His capability as an analyst was limited to the ability to examine facts as they presented themselves, and the possession of a certain "bargain sense" which enabled him to read his opponents' designs. He was a man of indomitable will, and possessed a certain ruthlessness. Calling these qualities into play, and taking advantage of the fact that certain natural resources of the country were unguarded at the time,

he had amassed millions for himself and his associates. He was the typical "shrewd business man" who was for a long time—in fact until quite recently—the American ideal industrial executive.

It has been my good fortune to know fairly well several financial leaders of that race which is sometimes accused of being interested in money to the exclusion of all else. My acquaintance with them has strikingly impressed me with their development of a philosophy of business, their inclination—almost without exception—to speculate upon the methods which bring success, upon the broad underlying laws of business. Moreover, I have been impressed with their desire to foster and follow high ideals. After all, wooden nutmegs and basswood hams are planned by narrow minds. The idea that every business is "different," and that it does not pay to plan far ahead because sufficient unto the day is the evil thereof, is the conception of shallow and short-sighted minds. The broad, deep thinkers, whose ideas and ideals have both kept pace with and aided America's industrial development of the last thirty years, know that there is something higher than business selfishness, and that honesty is literally the best policy. They realize that at the foundation of modern business administration lies a philosophy as noble and laws as exact as those which form the basis of any other science. They appreciate the importance of a systematic survey of the field, a comprehensive analysis of facts, a relentless follow-up in accordance with the policy adopted, and effective planning of all work.

The wolf type of financier-executive, however, is inclined rather to make business forays intermittently and, between forays, to lurk in his lair in comparative inactivity. He is inclined to wait and take just what chance brings him; just as the robber barons would wait in indolent ease in their castles on the Rhine until a caravan of merchants happened to pass, and then would seize what they could. In short, he depends almost entirely upon luck and inspiration.

Dangers of Impulse and Vanity.—It is extremely difficult to induce men of this type to conduct a business scientifically. They work in fits and starts. They have abundant energy, which carries them through periods of long hours at high pressure. Their methods of relaxation are often as fervid as their methods of work. They have little patience with systems, and they cut their way through convention and precedent with an utter disregard of the consequences—we have had ambassadors and cabinet officers of this type, at whose actions diplomats and other representatives of foreign governments have stood aghast. They want what they want when they want it, and woe betide the subordinate who ventures to suggest that their course is causing untold confusion and inefficiency in the business. Such men, on their periodical forays through the works, will fire employees right and left, with practically no provocation, regardless of the fact that they are weakening the authority of their foremen and superintendents and are destroying discipline. They will change the sales policy of the company overnight—and then change it back again. They will counter-

mand the orders of their staff with no regard for the feelings of their fellow-executives, or of their stockholders, who lose thousands of dollars as a result of such lawlessness, which destroys the morale and produces general chaos from one end of the business to the other.

Unfortunately such tendencies seem to "grow upon" the kind of executive who indulges himself in this way, but who is nevertheless "smooth" enough to maintain his control of the voting stock. I have seen a firm's best customers lost as a direct result of cavalier treatment which was wholly the outgrowth of an executive's habit of disregarding the feelings of his associates. I have known of executive forces which were in a continual state of turmoil simply because the management itself was lawless. New officers were lured in by the offer of high salaries, and then refused to endure existing conditions for more than a month or two. Consequently the members of the force had to keep climbing all over one another, changing places, like monkeys in a sack. I have known also of managers refusing even to talk with persons with whom, for the company's best interests, it was essential to consult—and merely because those managers, for one reason or another, disliked the persons in question. Such displays of temperament may be valuable press-agent stuff for a grand opera prima donna, but in executives who are appointed guardians of their stockholders' interests they can be characterized only as criminal. I have even known instances in which heads of companies were too vain to associate with their official

equals—to confer with managers of other and perhaps larger companies for purposes of mutual advancement and benefit—simply because they knew that, to do so, they would have to come down from those pedestals upon which they had placed themselves with the assistance of the servile flatterers they had gathered about them. Such managers are, however, becoming rarer, and it is fortunate for industrial America that they are. When twenty and thirty per cent dividends were comparatively easy to earn, many abuses could flourish which can no longer survive, now that the Federal Government has shown its disapproval of dividends of over eight per cent by taxing heavily all earnings in excess of that amount.

The Efficient Executive.—In direct contrast to the kind of executive that is passing, we have the new type of administrator—the scientific manager—the analyst and diplomat. Like his predecessor, he possesses personality, will, and a knowledge of human nature, all of which are essential; but unlike his predecessor, he bases his decisions upon facts—not upon a "hunch," or upon that mysterious mumbo-jumbo known as "experience."

Experience is a fine guide if a man is sure that he will never encounter any problem that he has not encountered before, and encountered often enough to learn how to deal successfully with the conditions involved. But how many men of experience at the head of our greatest and most successful industries have ever steered a hundred-million-dollar corporation through a world war? Yet there are Schwabs and Morgans doing that very thing to-day. No, sir!

When older men begin to prate about "experience," nine times out of ten you can bet your bottom dollar that they are trying to bluff a young man—or else that they mean something more than experience.

In the fifteenth century Machiavelli made a good general statement of the case when he said:

> There are three types of mind, the highest, which learns from the experience of others; the mediocre, which learns from its own experience; and the ordinary, which learns from neither the one nor the other.

But the modern executive must go a step further. He must not only learn from the experience of others —he must be able so to analyze a situation that he will be able to reason what to do when a combination of circumstances arises that has never been encountered before on the earth, in the heavens above the earth, nor in the waters under the earth. How long did the British and the French generals last who were so hidebound by what they called experience that they failed to cope with German attacks on land, in the heavens, and under the sea?

A certain maturity of judgment and a trained mind are prerequisites to success, as well as a liberal number of the qualities that were present in those supermen whom the ancient Greeks called philosophers. It goes without saying that a wide knowledge of human nature, a thorough grounding in practical psychology and a confidence in self, are essential. The question of how the executive shall employ these faculties and qualities in his dealings with associates and subordinates has been so ably answered by Professors

Gowin and Jones in their respective texts* that I shall not attempt to deal with it here.

When men over forty refer almost with reverence to "the confidence that comes with experience," unfortunately most of them do not have in mind that desirable self-confidence, gained in past crisis, which enables the executive to meet exigencies successfully as they arise. Too many of them are describing, whether they know it or not, a tendency to challenge the ideas of the rising generation—an antipathy to any and all innovation. Our great-grandfathers scoffed at the telegraph, our grandfathers at the aeroplane, our fathers at scientific management, and if we are not careful we shall find ourselves scoffing at some equally important means or sign of progress before long—if we are over forty. The following statement was made, not long ago, by one of the greatest executives I know—a man only thirty-eight years old, head of a corporation that controls a market in eight states through sheer efficiency of operation. "I am watching myself very closely now—the first time I find myself resisting an innovation, because it is an innovation, I shall turn the business over to the younger men and retire." He recognizes the common tendency to become ultra-conservative as one grows older, and has decided that if he becomes a victim of it, he will step out of the way and allow the progress in his business to continue.

And his decision is a good one. The complex busi-

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* Gowin, E. B., *The Executive and His Control of Men*, Macmillan Co., New York. Jones, E. D., *The Business Administrator*, The Engineering Magazine Co., New York.

ness problems of today cannot be solved by men who are unwilling to adopt the latest methods. Experience alone is not an adequate guide. No man could run any corporation a single hour merely on the strength of his experience. The analytical mind has become a necessity.

Training the Staff.—An important duty of the administrator who has just been quoted, is that of training his staff. Executive ability has been defined as the art of getting some one else to do your work for you—and the description is not far from the mark. This method of procedure does not by any means betoken laziness on the part of the born executive. Its adoption simply implies that once a job has been decided upon and the constructive work in connection with it has been carefully planned, the details hold no interest for the mind of unusual ability. Such a mind seeks other kingdoms to conquer and—to fall back on a hoary aphorism—"there is always room at the top," either in the executive's own corporation or in some other. The far-sighted man—the man who will make progress, and whose rapid rise is often a mystery to his acquaintances—realizes these facts, and that is why he is always training understudies to take his place, instead of jealously guarding what he has learned for fear some one will find out enough about his job to get it away from him. The successful executive is a pioneer, and the milestones in his path to the heights are the men he has taught to fill the jobs that he has outgrown.

A safe maxim then for the man who would rise is:

Never do anything yourself which one of your subordinates could do for you. The first time a job is done you may have to do it yourself. In that case spend your time as lavishly upon its detail as is necessary in order to insure complete success. Next time, teach some one else to do it. The third time, kill that person if he does not do it correctly.

The amount of time that mediocre executives spend on useless detail is appalling. I know of one man who dictates innumerable letters beginning "Yours of the 11th instant received and contents noted. In reply we beg to state, etc., etc." One of his stenographers told me that his letters are a standing joke with her and her associates. They know his letters by heart, so that they simply scribble nothings while he dictates. When he comes to prices and quantities they jot those down, but everything else they compose themselves, later. I suppose that this man fritters away, on the whole, a third of his time and a third of his stenographers' time in this way—but how he does enjoy rolling out the bromidiums in stentorian tones to his apparently respectful slaves. The stenographers might just as well write these letters from forms.

Handling Correspondence.—The handling of the correspondence often determines the efficiency of the business. In this connection, it might be stated, printed forms and rubber stamps will not make an executive. At the same time they may be valuable aids to a naturally poor executive, and may help him to become a better one. To illustrate what I mean I shall quote a written recommendation that straightened out a number of snarls in the correspondence department of a large western corporation.

Disposal Current Business.—It is essential that the management of any large concern have the leisure to analyze operating and sales conditions, to consider questions of business policy without haste, and to devise various new methods of increasing the profits, of increasing the sales, and of raising the general efficiency of the organization.

In order to give such matters the consideration they deserve, the men at the head of a concern must be freed as far as possible from detail.

It is right and necessary, however, that a great many communications should be addressed to the management—as a matter of courtesy—and to convey needful information to the management as to the state of affairs at the Company's factories and in various sections of the sales territory.

Only a small percentage of such communications demand personal action or decision on the part of the management. Department heads and assistants of various sorts are quite capable of taking care of a large number of such letters.

Furthermore, if as great a proportion as possible of all letters reaching the management are referred to others for action, a good many matters which might hang fire for days, the letter lying on the chief's desk until he had time to secure the necessary details, would be attended to at once by those already in possession of full information.

In order, therefore, to keep the desks of the management of the Imperial Manufacturing Company as clear as possible at all times, to facilitate the handling of business, and to place responsibility exactly, the two following stamps have been provided:

Noted • P.B.R. Pres.	Noted • J.C.P., Gen. Mgr.
JUL 24	JUL 24
Ref. to ______	Ref. to ______

We recommend, then, that:

I—All letters coming to the desk of the President or the General Manager be stamped at once by them, as soon as read, with their respective stamps and with the proper date.

II—That all such letters be marked at that time with an assistant's initials, and referred to him for attention whenever possible, and given to the messenger boy for delivery.

III—That the man to whom the letter is referred be instructed to return the letter to the management with notation showing what action has been taken, as soon as the matter has been disposed of.

IV—That the stamp then be crossed out by the Management and the letter placed in the "To Be Filed" basket as closed business.

Waiting Line a Menace to Efficiency.—Some executives are miserably unhappy unless at least one person is always waiting to see them. But if they are rushing through one interview, incidentally missing half its fine points—and it is the little shadings of the voice and the unconscious facial expressions that disclose much of a man's real purpose—so they can begin to rush through another in the same way, they are happy. They feel sure that they are very busy and that they are earning their salaries. One man I knew was even boor enough to read his mail while men of thrice his caliber were talking to him about important matters. When he had finished half an hour of such a performance he knew neither what was in the letters nor what had been said to him, and his caller would go out of the office mad enough to indulge in almost any revenge. And the company naturally suffered—it is hard to tell how many thousand dollars were lost because of this man's inexcusable practice.

At one time I was engaged in organizing the planning department of a large metal-working company, a piece of work that involved the compilation of a

considerable amount of information in the auditor's office. A short time before, the chief had been complaining about how badly he was overworked—how it was impossible for his department to keep ahead of their work, and how much he needed more men. An hour in his office told the story. Actually, during the time I spent there at least two or three men—an average estimate—were waiting about his desk to ask him questions. Sometimes there were six or seven. At first I thought the trouble was caused entirely by a desire on the part of the executive to feel busy and important, but I very soon found that I was wrong. An experience of the young man I was working with made the matter clear. We were going over some store cards. As soon as we struck one we did not understand, this youngster started for the chief like a bloodhound that has slipped his leash. He joined the crowd of five or six around his chief and stood there ten minutes until his question could be answered, meanwhile leaving me to busy myself as best I could. Five minutes later he repeated the performance. That was enough. It was clear that the chief needed to use a blacksnake whip—or its mental equivalent—to clear out the crowd of employees around him who preferred to sit on the edge of his table and wait rather than use their brains. The trouble was, that man's job bossed him—he didn't boss his job. He was working himself sick, a third of his clerks were loafing—and he didn't know how to mend matters.

I told my young assistant thereafter, instead of working at the cards two five-minute periods and

then waiting two ten-minute periods we would segregate all the cards we couldn't puzzle out, and have all our questions answered at one time. While I did not know exactly how much time this plan would save, I did know that it would save a great deal. And I knew, also, that if every one in the department should adopt the same simple, but important rule, the Chief could both turn out all the work of the department on time and dispense with at least a quarter of his clerical force.

Bossing Your Job.—One of the greatest mistakes made by executives is that of taking what comes to them—instead of sending for what they ought to have. That fact cannot be too strongly emphasized. The man who lets his subordinates determine what they shall take up with him, the man who lets chance determine what visitors he shall have, the man who lets his job boss him instead of bossing his job—that man is not doing his duty by himself or by his company. Once you have taught your subordinates what kinds of questions they must answer for themselves, and what kinds of questions they cannot answer because they have not had access to all the information which the boss is in a position to secure, then it is all well and good to let them use their judgment as to when they are justified in using your time in consultation. Such an arrangement will prove an excellent preventive of such a chaotic state of affairs as I have just described.

After you have taught your office boy, your stenographer, or your secretary how to interview visitors tactfully and how to weed out those who have no

business to consume your time during office hours, you are safe in seeing the other visitors that remain on the list. The man who wants to borrow money, the man who sends in his personal card with the request that he may see you a moment on "personal business"—and who, if he does see you, unfolds a compendium of the "World's Best Poems" from his coat-tail pocket, and the man who has an axe to grind, all will seek you. But are these the most important men for you to see if you wish to serve your company, and incidentally yourself, to the best advantage?

If you will analyze your job and will lay out the work in such a manner that important matters always and forever take precedence over unimportant matters, and then if you will resolve to stick to the important, come what may, you will find that you are master and that that hurried, inefficient busy creature who was fretting himself into an early grave has become only the memory of a nightmare.

It is by no means easy to arrange matters on this basis, but it is essential to do so. The principle involved is the all important thing; the application of the principle will naturally vary with each individual case. Not every one is born to the captaincy of a corporation and steps into control of a corps of trained secretaries one of whom places on his desk each morning a schedule for the day showing the time and place set for every appointment, the names of the persons to be met, and a digest of all the important matters to be discussed. Not every one can have a secretary hovering, watch in hand, outside the

door during an interview, prepared to choke off the visitor with a tactful but incontrovertible excuse when the appointed time has been consumed.

Oliver Wendell Holmes used to plan a verbal toboggan slide, whereby to get rid of callers, toward which he would tactfully urge his visitors from the country who could not find words that would terminate their visits. We may have to follow his example. Or we may have to cultivate that old school courtesy of President Hadley's—as soon as the business of an interview is really concluded, he stands at the open door bowing to the visitor until the latter bows himself out involuntarily, through the very force of example. We may have to install a buzzer which, touched with the knee summons our stenographer—or some other fellow-conspirator—from the next room with the startling news that the building is on fire, that grandmother has just thrown a fit, or that John D. Morganfeller is waiting for us in the corridor.

A secretary can make appointments for you, but he cannot keep them for you. It is a simple matter for the executive to make appointments by telephone, without the assistance of a secretary. Appointments must be kept to the minute. The only valid excuse for not keeping an appointment is the death of the man who made it. If you are late in making your appearance, you not only insult the man whom you keep waiting, but you acknowledge that you are a liar and a cheat—and there is absolutely no excuse which you can make. If this is clearly understood by business men in their dealings

with one another, not only can an immense amount of time be saved by all concerned, but the work of each can be planned and performed with remarkable efficiency.

The Limited Interview.—The arranging of a schedule is not so easy. Matters are simplified, of course, if, on account of the importance of your position, people will accept your ruling as to when you will see them. But most of us are not such great men that the public will excuse us from abiding by what the world chooses to call the laws of common courtesy. We must therefore either have regard for the convenience of our visitors, or have some tactful person indulge in polite fiction of some sort in the interest of our efficiency.

If you decide to see a visitor when you should not take the time, you should frankly tell him that you are giving him valuable time, and then keep the interview within reasonable limits. I used to know a man who apologized so beautifully that I suspected him of insulting people just to secure the opportunity to make them firmer friends by using his most engaging manner in making reparation. If you will take your visitor into your confidence, explain the situation, with both frankness and regret, and send him out of the office warm with the glow of having done a friend a favor, you can finish your work and at the same time avoid giving offence. The men in college who are the most popular are not those who are always ready and eager to drop their work for a visitor. They are the men who will devote ten minutes to a friend whole-heartedly, and then chase him

out of the room. Exactly the same thing is true in business.

A limited interview has its benefits for the caller as well as for the man who receives him. A good salesman will make a better selling talk if he knows that he has only fifteen or twenty minutes in which to do business, and that he must "put it over" in that time, than if he knows that he has the whole afternoon to dawdle along in, and so doesn't have to "make it snappy." A man's whole and eager attention for ten minutes is worth more to a visitor, if the latter only knew it, than an hour of half-hearted hospitality. A sales-manager not long ago analyzed for my benefit business methods in two cities—one of them noted for the great amount of business it transacts with dispatch, the other notorious for its sloth and lack of enterprise. The two anecdotes that he told photographed the situation:

"Just as Thompson came out of his private office a man stuck his head in the door and shouted, 'Are you on?' Thompson nodded. 'How much?' 'Thirty thousand,' said Thompson, and the deal was closed."

"Two days later I called on Walsingham in ———. He listened to me politely for three hours. Then he told me he would have to think it over—to come back next day. The next day, after about an hour's talk, he said he would have to see his banker, took me out and bought me a drink, and told me to come back in about two days. I was just boob enough to fall for it. He gave me another hour, and then asked me to take it up again in a week! Oh yes, he was polite, blasted polite! But the next time I try

to do business in that town, just turn in a call for Bellevue—I'm through!"

Conserving Time and Energy.—Perhaps the executive who is just at the point where he needs a professional secretary is the one who has the greatest amount of difficulty in doing his own work effectively, in seeing outside visitors as promptly as courtesy demands, and in avoiding wasting the time of those subordinates who have legitimate reasons for demanding a share of his time. Many such men in the country waste a great deal of their assistants' time. They are like a certain executive I know, who is at the head of a concern employing nearly two thousand men. If you should want to see him you had better make up your mind to waste several hours in doing so. The procedure would be something like this: About nine o'clock you would phone to find out if he were in the office or if he were to be there that morning. If he should be out, but should be expected later, you would phone him some time after that for an appointment. He would tell you to come in about eleven o'clock. Promptly on the minute you would arrive—only to find him conferring with two or three other men. You would hover around the glass partition for fifteen or twenty minutes—he always sits with his back to the door—and then, as the conference would seem likely to last indefinitely you would go back to your work. A little later in the day you would return, only to find him closeted with some one else. The next time you returned, he would have gone out to lunch, and in the afternoon you would be told he had gone to the works.

There were always two or three men hovering around that manager's door all the time—high-priced executives, anxious to get a word in edgewise. Any number of important matters that should have been attended to promptly lagged along for several days, and thousands of dollars' worth of time was wasted every year. If that man did not feel that conditions warranted his having a professional secretary—and they really did—he could at least have had his private stenographer keep a schedule of appointments on his desk, and then he could have made an attempt to live up to it. The adoption of such a course would have prevented the necessity of any one's waiting around outside his office. Moreover, whoever wished to see him could simply have phoned the stenographer for an appointment; and whenever the executive was late, the stenographer could have changed the time of the appointment. Such a schedule is the means of saving far more than the time it takes to prepare it.

Planning—The "Tickler" System.—Some time during the day you must plan your work. If you do this planning piecemeal you will be sure to leave some important matters until so late in the day that it will be impossible to attend to them. Very often, if planning is done in a hit-or-miss fashion, matters which could have been arranged in an instant by phone early in the morning, have to be frantically looked up later in the day, and consume half an hour or more. Piecemeal planning also requires going over the same ground time and again in order that business which has been overlooked may be attended to.

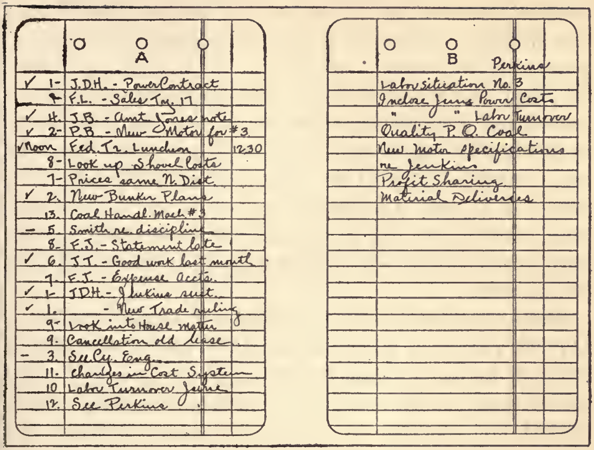


FIG. 5. PAGES FROM AN EXECUTIVE'S NOTEBOOK

As soon as he arrives at the office, the executive jots down in his notebook the things to be done that day. He then marks the order of their importance in the left-hand column. When two or more matters can be taken up with one man, both are given the same number, thus "1—" is the most important item slated, the dash indicating that there are other matters to be taken up with the same man. A period following the number indicates that this is the last or only item to be taken up with that one man. When one of the duties scheduled cannot be performed, a long dash is placed before the figure, and when a matter is disposed of it is then checked off. The second page (B) shows subjects which have been jotted down—perhaps for a week past, to be taken up with one man (Perkins in this instance) at the time of the next trip to Plant No. 3.

If all work is planned, as far as possible, the first thing in the morning and a note of the things to be done is jotted down in a memorandum book, it will not be necessary to go over the ground more than once. (See Figure 5.) Everything will be covered

logically in sequence, and at the proper time. Any one who has tried such a system appreciates its value: points written down cannot be overlooked or forgotten, and the matters on the memoranda recall others, associated with them. The various items should be numbered in the order of their importance; then the important things will be done first and the unimportant will be left till later. Consequently if any matters have to be long postponed they will be those the temporary neglect of which will mean the least loss to the firm.

Some men expand this "tickler" system to cover several pages in their notebooks. The first page is devoted to memoranda on the work for the day. The second page contains notes concerning business which should be attended to in the immediate future, but which might be overlooked if memoranda were not made. A third page lists affairs to be attended to in the more remote future, or at certain factories, or points to be discussed with certain individuals who are seen periodically. While the value of the calendar pad is too widely known to call for special comment, it is a surprising fact that comparatively few men use it to the best advantage.

Follow-up Illustrated.—The cultivation of the memory is by all means desirable, but the memory is not a safe court of last appeal for the executive of today who must do a great amount of detailed work, and who must be able at any time to produce accurate data at a moment's notice. The use of a pocket notebook, together with larger notebooks for the desk, in which to note necessary details for attention at the

proper time, enables the executive to concentrate his time and energy upon the important problems at hand.

A sure and relentless follow-up of the kind described is one of the greatest possible aids to executive effectiveness imaginable. Any one who has not had actual experience in such matters can hardly imagine the amount of conferring and order-giving that comes to nothing in a large corporation. I remember a general manager's once telling me about the case of an influential stockholder who never forgot. "Most of my directors," he said, "who want something done, forget all about it in a little while. So it is usually easier to agree with them than to argue. But Blank, he is the very devil. He never forgets about anything he tells you to do." The manager found it difficult to explain how this man remembered unfailingly. Blank, as I found out later, had a little notebook in which he made a note of everything he thought the general manager ought to do. And he didn't cross out any note until he knew for certain that his directions had been carried out! He certainly was the very devil—for getting things done.

It can be said without fear of exaggeration that persons in authority give thousands of orders that are never carried out. Many harrassed minor executives have been brought up in the belief that no matter how many extra hours they have to put in, they must exert superhuman energy and do every job that comes their way. They listen to the dictum of the boss respectfully and then, if circumstances will not allow them to accomplish what he has given them to do,

they simply hope he will forget what he has told them. And he usually does, if the foreman hasn't been foolish enough to argue the matter and so impress matters on the boss's memory. The boss is to blame. Either the order shouldn't have been given, or else it should have been followed up systematically until it was carried out to the letter. After one or two follow-ups, there is less need for them in the future—and discipline throughout the organization improves decidedly.

Another quotation from a recommendation made to the western corporation mentioned in this chapter will help to show the value of the follow-up method.

Consistent Follow-Up.—It has become a firmly established rule of the successful American corporation that decisions must be made promptly—once the situation has been thoroughly investigated—and that as soon as the decision is reached, it must be followed immediately by vigorous action.

A Fabian policy is often extremely successful in politics or in trading and bargaining, but it is ruinous where those kept in suspense are members of an executive organization. In order to avoid unnecesary and inefficient action, therefore, and to avoid entire lack of action at a time when it should be vigorous on the part of the various members of a company's staff and line organizations, decisions should be reached by the management as soon after the facts are set before them as possible. Such decisions must be followed up vigorously by the management if discipline is to be maintained, if the various members of the organization are to act in concert, and if the business is to be operated efficiently.

Furthermore, the moral effect upon members of the line is bad if the management of a company demands certain information or certain action from subordinates, and then ignores the failure of the information to appear, or of the action to be carried out as directed. Under such conditions the subordinates very quickly find out that promises satisfy their superiors quite as well as action, and that the easiest

way to forestall criticism is to insist volubly that "everything is all right." For this reason, requests for information and orders issued must be followed up consistently by the executive until the results desired are secured, if he is to be fair to all and is to do his part in insuring the efficient operation of the business in all departments.

The supreme authority in any business is necessarily vested in one man. Whether he gives his orders directly to the Factory and Sales Managers, or whether he delegates his authority, and his orders are transmitted to the departmental heads through associates in management, he necessarily has always given certain orders which have not been carried out. The higher a man's position, the greater the necessity that he be consistent if he is to secure the respect which he must have to administer the business effectively of which he is trustee. When the chief executive gives orders, therefore, he should see that they are carried out at all costs, whether they be given to his assistant executives or directly to departmental managers.

Remedy for Executive Inefficiency.—I have seen many an executive conference that consisted of a debate in which the affairs of the company were settled and resetttled to the satisfaction of all present; every one voiced his own pet ideas—and not one thing was done as a result of the conference! After the debate every one walked out feeling that he had more than earned his salary for the day. And yet, what appeared to be everybody's business was, in the end, nobody's business; since no very clear conclusion had been reached, no one felt impelled to see that the mass of verbiage was translated into action in any quarter.

The remedy for such executive inefficiency lies in the application of the following three simple rules:

1. Never give an order unless you intend to see it carried out.

2. Never change an order unless the conditions which gave rise to it have altered.

3. Never cease following up an order until it has been carried out to the letter.

It may be a difficult matter to establish a reputation for carrying out these rules relentlessly and without exception, but once your subordinates know that you mean what you say, your work will become decidedly easier. Every time you give an order and do not follow it up, you are bluffing—and it will not pay you to bluff in an organization. You will be discovered, and then your orders will be no more regarded than the threats of those foolish mothers who try to command the obedience of their children by telling tales of goblins and other dire apparitions. Nobody believes a liar even when he is telling the truth.

The executive, if he is to be successful, must teach his subordinates that he means exactly what he says—no more and no less. Unconsidered words lead to serious dilemmas. A bride I knew told her Japanese house boy, on one occasion, that the next time he did not come home when he promised, she would discharge him. Soon afterwards, when he had an afternoon off, his friends proved alluring, and when he finally returned he had delayed dinner for hours. The lady knew that she could not get another servant to compare with Tenigero, so she was in the unpleasant position either of having to appear to her servant as a self-convicted liar, or of losing a treasure. The executive who attempts to rule by bluffing finds himself in a similar, but far more serious

situation. If you would preserve discipline, conserve your time, and increase your efficiency as an executive, never imply that you will do anything that you are not prepared to do literally—even if you may have to work ten nights on a trial balance yourself, or take off your coat and fire the boilers, to make good.

Delegating Authority.—It is essential to discipline, and therefore to efficiency, that the executive support his subordinates. My first assistant-superintendent came to me one day, almost with tears in his eyes, utterly discouraged because certain men were meeting his orders with the statement that the boss had ordered to the contrary. The trouble was explainable partly by the fact that the foreman had been accustomed to taking orders from me and the habit continued strong. In certain instances, men who were jealous of my assistant's rise went out of their way to obtain orders from me so that they could indulge themselves in the joy of thumbing their noses, as it were, at a person whom they considered an upstart. Then there was that ever-present type of workman who will always go to headquarters for his orders if you will let him, much as the patrons of the country store always insist on being served by the proprietor. The result of conditions was that the assistant superintendent, whenever he issued an order in certain quarters, received what was equivalent to a slap in the face, for his order was absolutely disregarded. Furthermore the superintendent's time was being continually wasted. This situation resulted in the formulation and enforcement of the following rule:

The executive must, whenever possible, give his orders through his subordinates.

Common sense must be used in the application of this rule, as in the application of any other. The method of transmitting orders can be carried to an absurdity, of course, as in the case of the General who wanted his suit cleaned—the General ordered the Colonel to order the Major to order the Captain to order the Lieutenant to order the Sergeant to order the Corporal to order Private Atkins to clean the General's suit. But the General grew impatient before the order reached Private Atkins, and cleaned the suit himself. In an emergency the executive must give orders immediately, directly to whoever must carry them out. But under ordinary circumstances it will be more conducive to efficiency in the organization if the executive will discuss matters with his department assistants, in his own office, where access can be had to all sorts of illuminating data—and then issue orders through the assistants. And in order to be able to discuss affairs intelligently, he should mingle with his workmen, talk things over with them, and make notes concerning any conditions he thinks should be changed.

Facts Versus Opinion. — The executive meetings must not be allowed to degenerate into fruitless debates like those I have already mentioned. Subordinates can be trained with comparatively little trouble to base their decisions upon fact rather than upon personal opinion alone. The following case illustrates how inefficiency may result from an ignorance of the facts. A year or two ago the secre-

tary of a large cigar-manufacturing company showed me through the plant. In one room there were about two hundred girls stripping tobacco leaves—tearing out the stems in order that the rest of the leaves might be used for cigars. On one side of this room half a dozen stripping machines were being operated. I asked the secretary which was the better method of stripping—the hand method or the machine method. "Well," he said, "I really can't tell you. We have discussed the question a great many times this last year, and there is a difference of opinion among the members of the firm." Twenty minutes' timing would have settled the matter—and yet the firm members had debated the question for over a year! If they had known the facts, things would have been different. Given the facts, the problem usually settles itself—without any necessity of recourse to oratory or to acrimonious expression of opinion. Discussion without facts is merely "the rustling of the wind through the dry reeds," and seldom leads to decisions of any importance.

It is the first duty of the modern executive so to marshall the facts that problems of the corporation will, so far as is possible, solve themselves. When his assistants—sometimes composing a highly organized statistical and industrial engineering department—have placed the facts before him in such shape that he can act upon them in the best interests of the business, he is in a position to devote the greater part of his energy to translating them into definite and decisive action.

CHAPTER VII

THE GRAPHIC METHOD OF PRESENTING FACTS

One-Man Graphic Method.—In the preceding six chapters I have endeavored to show the development of the industrial world which the executive rules—or which rules him, as the case may be—and the necessity of basing decisions upon facts. I have explained briefly one way of gathering these facts, and have touched upon some of the methods by the use of which the executive may conserve his time for a consideration of the important problems of business administration.

Before proceeding to the examination of the executive's method of controlling the business by the use of facts—in the form of statistics, graphic representations of conditions, and so on—I wish to say something in regard to the art of preparing graphs and charts. It is not my purpose to attempt to write a treatise upon this very broad subject, which has been ably covered by Mr. Brinton.* Nevertheless since it is sometimes necessary for the executive to start some one off on the work of preparing graphs—and since he may sometimes wish to try his hand at it himself in odd moments, I believe that a direction or two may not be out of place here.

* Brinton, W. C., *Graphic Methods for Presenting Facts*, The Engineering Magazine Co., New York.

The president of a certain corporation capitalized at several millions—a man who has done a stupendous work of reorganization, and who has made his company a power to be reckoned with in the Middle West—found time until recently to draw up his own graphs, in spite of his superhuman labors. He carried around with him pencils of several different colors and some thin co-ordinate paper. Whenever he analyzed statements, reports and statistics—in his office, on the train or at his home—he put down the figures on the co-ordinate paper if possible. Then when he wanted to illustrate the recommendations he made in any letter—whether to a superintendent or to his board of directors—he crammed in two or three graphs. As a result, he got everything he wanted. The facts argued the case for him. Once the graph was examined, no plea was necessary. Only one course was open—the right course—and that was followed. The president's success and his company's success automatically followed.

Under the circumstances his graphs were often mussy and soiled, of course, but they brought home the facts with irresistible logic. Now he has a scientific statistical department and his graphs are all that could be desired, but I doubt that he enjoys them as much as when he was grubbing them out himself—putting his business ideals on paper, as an artist expresses his ideals through the medium of his art.

Advantages of Ruling Pen.—The colored pencil is a fairly satisfactory makeshift for the use of the man who has to carry his statistical department in his

inside coat pocket. It is impossible, however, to draw a fine line with the usual colored pencil. Moreover, owing to the difficulty of keeping a sharp point on such pencils, lines drawn with them very often break and waver, so that it is impossible to do a neat job.

A ruling-pen is a much more satisfactory instrument, but the novice is advised not to attempt to work anywhere but upon a stable surface with an outfit of colored drawing inks. The most satisfactory type of pen is that which one can pull open like a jackknife without disarranging the set of the thumbscrew which regulates the width of the line drawn. This type of pen can be cleaned, or the ink can be changed in the shortest possible time, and these points are worth considering.

Inasmuch as the width of the line is important, in regard to both the appearance of the finished graph and the differentiation between various lines on the same sheet, it is important to have some means of adjusting the pen to standard line widths at a moment's notice. A pen with a scale on the set screw may be used, or a scale may be scratched on an ordinary set screw (see Figure 6). If you arrange the scale yourself, set the screw first at the widest line the pen will draw without spilling the ink, then at the narrowest, and then divide up the intervening space with six or seven different sorts of marks.

Paper and Scale.—The use of colored inks is very effective when several lines are to be platted on a single sheet. There is the disadvantage, however, that usually only a single copy can be made, and it

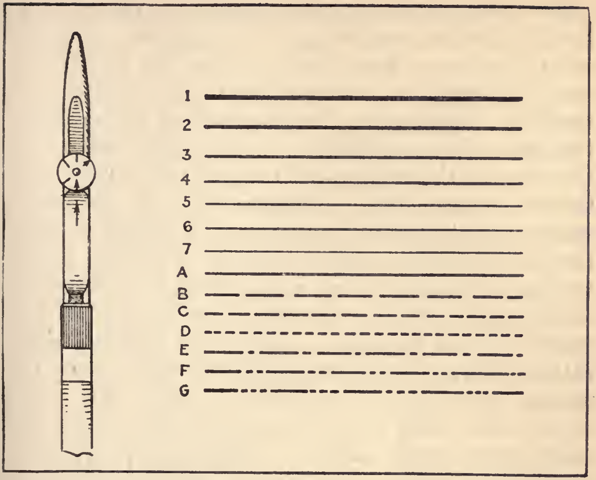


FIG. 6. A GRADUATED RULING PEN AND CORRESPONDING LINES FOR THE GRADUATIONS

By marking such graduations on the set screw of the pen, standard widths of line may be obtained. A good pen thus arranged can make from five to seven distinct widths of line. With seven line widths and seven types of line as shown by A to G, forty-nine different lines can be drawn on one graph if such an occasion should arise.

is usually desirable to have several. I would therefore advise the use of a thin co-ordinate paper, from which blue prints can be made. Curves platted on this kind of paper can be continued on the blueprints with white ink until such time as it may seem advisable to make another blueprint. If various sorts of broken lines and lines of different widths are used, all the variety needed can usually be obtained, as the illustration shows.

The selection of a paper adapted to the work in hand is always something of a problem. Recently several concerns have been getting out co-ordinate paper divided into twelve and fifty-two sections respectively representing the months and the weeks of the year. The appearance of this paper adds considerably to the neatness of the finished graph. Millimeter paper with approximately ten squares—which can be used to represent cents, dimes, dollars, tens or hundreds—to the half-inch, and with fifteen such squares on one margin and twenty on the other, is very satisfactory. The ruled surface of such a sheet is 7½ by 10 inches, a size which allows a satisfactory margin when the sheet is bound with the regular 8½ x 11-inch typewriter paper. The next largest size—with twenty squares on one margin and thirty on the other—allows a satisfactory margin for binding with the 8½ by 11-inch paper, if the sheet is folded once.

On the smaller sheet, it is sometimes a distinct advantage to have the three extra squares over the twelve required for the year, for lettering and so on. The larger sheet allows space for fifty-two weeks if a five-millimeter space is used for the week. Logarithmic paper possesses a distinct advantage, since on it can be shown, if desirable, the fluctuations of several factors which combine to form a total, whose fluctuation it is also sometimes well to show. An attempt to represent on ordinary paper conditions of that sort would result in congestion among the factors, and a large section of blank paper between them and the total—even if the total can be shown on the same

sheet without interrupting the continuity of the scale. The use of logarithmic paper makes it possible to take care of the occasional "freak" peak which is always disturbing the artist by running completely out of the picture at the top of the scale. Compare the same data platted on the ordinary co-ordinate paper and on logarithmic paper in Figure 7.

It is important to represent the whole scale from zero to the highest point reached, because by doing so conditions can be shown in such a manner as to be more easily read in terms of percentages. Thus, if figures running from fifty to sixty cents are shown on a scale that starts at zero, they will call up a much more accurate mental picture of their relation to one another than if they were shown on a scale running from 50 to 100.

Graphs Show Relative Values.—One of the most important functions of graphs is to show matters in their true relative importance, and it is essential to have a man draw them up who has a clear idea of the relative importance of the factors and operations in the business. An artist who paints a picture or a sculptor who models a statue does not endeavor to show the subject exactly as it is. Ask either one what he thinks of photographic art and you will get the whole story. The artist doesn't accentuate the freckle on your nose, unless that freckle is important to the expression of your personality as he interprets it. He studies you and endeavors to portray the real "you." If he is a true artist, he will make your true character and personality stand forth from the canvas as the character of Washington stands forth from

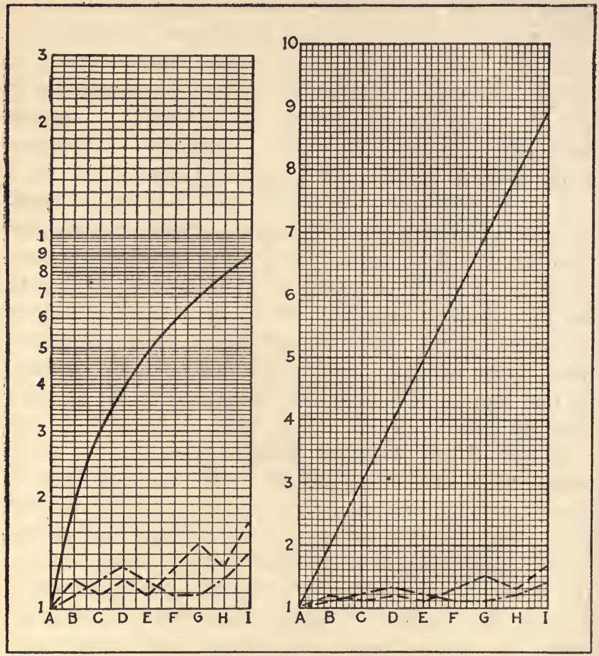


FIG. 7. IDENTICAL DATA PLOTTED ON ARITHLOG PAPER AND ORDINARY COORDINATE PAPER

Note the greater clarity of the two lower curves in the first case, also the fact that less room is required for the upper-curve.

the Stuart portrait, or the personality of Victor Hugo from the statue by Rodin. This does not mean that art must lie. It means that art must be truer than any mere mechanical representation of the obvious.

The camera is accurate as to externals. But the true work of art is to portray accurately not only externals but the subject's true personality, through the instrumentality of the artist's experience, technique, intuition, and ability to analyze the soul of the subject.

The case of the graph is similar. The bookkeeper shows the losses in red, the color of danger. The statistician draws the curves that portray undesirable conditions or items—such as losses during production—in red, to indicate their menace to the business. But he must do even more than this. He must show figures whose fluctuation spells disaster—such as those dealing with output and labor available—to a scale which will accentuate every fluctuation. He must make the instability appear frightful—as it actually is to any one who knows the effect of violent fluctuation in certain vital factors of industry. Even though a drug may be fatal only if taken in extreme doses, the druggist marks it "poison" and emblazons the label with the skull and cross-bones. He knows that nine times out of ten the dose that a person would ordinarily take, would not prove fatal, but he marks the drug "death" nevertheless, because he wishes any one who is going to make a mistake to err on the safe side. Similarly, it is an axiom that the conscientious industrial engineer, or the executive who wants to keep himself unfailingly on the right track, will arrange his graphs so that they will exaggerate dangerous tendencies that must be avoided if the business is to be run with the maximum effectiveness.

Men Who Make the Graphs.—As its corrolary this axiom carries the rule: "Statistics and graphs should be planned by men who have analyzed the business from the stage of the arrival of the raw material to the stage of the shipment of the finished product—who know, through actual contact with the working problems of every department, its tendencies and the causes which underlie its effects." Even the lowliest bookkeeper on the tallest stool in the darkest corner of the office cannot perform his duties properly if the entries he is making are nothing but names to him. He must visit the factory, he must see the finished product, and make every word he writes vital, if he is to perform his duties efficiently. Some of the worst errors I have ever found in cost statements were due to the clerks' ignorance of conditions in the factories. Errors that the most ignorant "hunky" at the works would have scorned to make were perpetuated by supposedly trained accountants, simply because what they were writing down meant nothing to them but words, words, words!

Expert accountants will make the same sort of foolish errors in devising cost methods. A firm of accountants of excellent standing in recommending a system not long ago to a great association of manufacturers, solemnly asserted that it was unnecessary to tally the output of a certain department if the losses were counted, since the subtraction of the losses from the output of a previous department would give the number of good pieces with accuracy. From the accounting standpoint such a procedure seemed efficient.

From an operating standpoint such a procedure was unreliable, unsafe, and immoral. Tally, in this particular case, was made by the very men who would be disciplined if losses were unduly large; such a system simply begged them to lie to the firm. One firm, which is audited annually by the best known firm of expert accountants in the country, discovered a loss that had been going on for years in one department—amounting to over $13,000—simply because the same men who were responsible for the loss did the tallying. They didn't want to hang themselves by reporting their own crimes. Costs, statistics and graphs, if they are to perform their true function in the administration of the business, must be devised by those who are familiar with the business and with the problems which confront its executives, from the lowest to the highest.

The men who keep up the work, once it has been intelligently planned, should be made conversant with the tangible physical actualities. Then, too, every business is continually in need of new blood if it is expanding. And if it is stagnating, the need is doubly pressing. If cost clerks, bookkeepers and statisticians are carefully selected for their potential skill, and then are brought into direct contact with the processes and with the product through regular trips to the factory, the company is furnished with a continuous and inexhaustible supply of the kind of material out of which executives and salesmen are made. Men so trained are not only of greater value while they remain in the accounting department, but they also prove more valuable as superintendents and

salesmen because of their knowledge of the underlying facts of the business, and because of the opportunity which they have had to observe from day to day, in the figures with which they are dealing, the effect upon the business of the various current conditions and circumstances.

Once the instruments of expression have been chosen—the tools, the inks and the co-ordinate paper—it is necessary to plan the particular graph which is to picture conditions for the executive's benefit. In doing this, the statistician must not regard himself merely as a recorder of facts, or even as an artist who is to portray the soul of the business. He must go still further, and look upon himself as an important agent in the shaping of the company's policy. Cardinal Richelieu, the real ruler of France for years, did not issue orders to the people of France. He placed the facts before Louis XIII in such a way that the latter, in each instance, could do only one thing. As a result, the rule of the Grande Monarque was the most brilliant in the history of the country.

It may not be possible, or even desirable, for the statistician to rule the business through the general manager, but it is desirable that he realize his responsibility and his power for good or evil since upon both the facts and the method of presentation that he selects depend, to a great extent, the decisions of the executives who control the destinies of the business. The statistician therefore not only should be a man of the highest integrity, but should realize his responsibility and prepare himself accordingly. Upon his action—upon whether he is a Rasputin or a

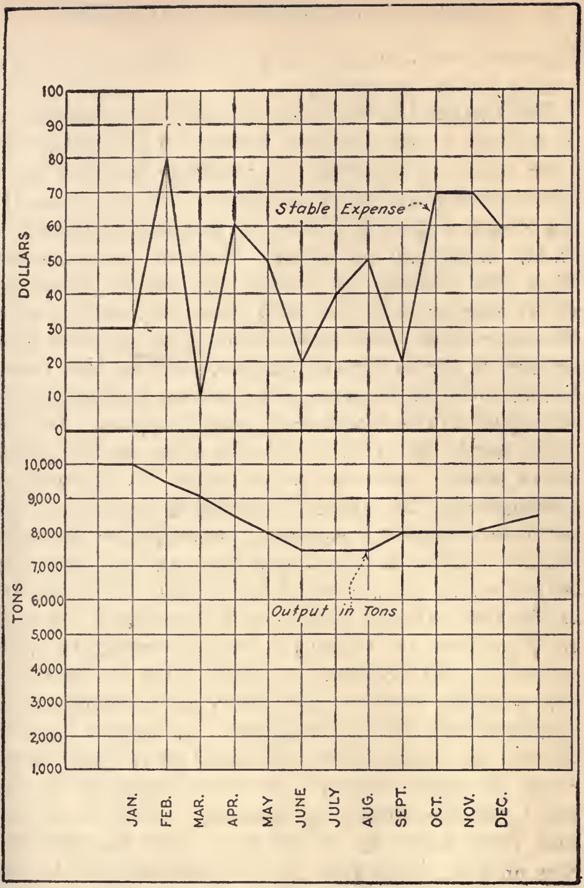


FIG. 8. SHOWING DANGER OF GIVING MERE DETAILS UNDUE PROMINENCE IF CARE IS NOT EXERCISED TO ARRANGE CHARTS TO ACCENTUATE MATTERS IN THE ORDER OF THEIR IMPORTANCE.

Richelieu—will perhaps hang the destiny both of his master and of his empire.

The Control Curves.—The reductio ad absurdum is sometimes a very effective method of presenting the facts either to facilitate an executive decision or to illustrate a point under discussion. The accompanying graph, Figure 8, brings out the point emphasized in the preceding paragraph. Suppose a statistician were fool enough to present the facts concerning stable expense and the facts regarding output upon the same sheet—and suppose the executive were idiot enough to accept the graphic picture at its face value. Under such circumstances the violent fluctuations in the upper graph would seem most alarming. On the other hand, the mild and gentle drop in the output curve would seem to be no cause for uneasiness. Consequently, the executive would be moved to rush forth and conduct a searching investigation of stable affairs. While he was doing this—say in June—the output would have dropped 25 per cent since the first of the year, without attracting his attention. A drop of 25 per cent in the output is often enough to drive a concern into bankruptcy, while thirty or forty dollars a month more or less spent in the stable is of comparatively little consequence. In view of the conditions, the statistician's statement of the case shows about as good judgment as that displayed by the small boy who rushed up excitedly to tell the farmer that there was a fly on his nose, when his shirt-tail was on fire. Both facts were interesting, but it was of considerable importance to the farmer to which affair he gave his first attention.

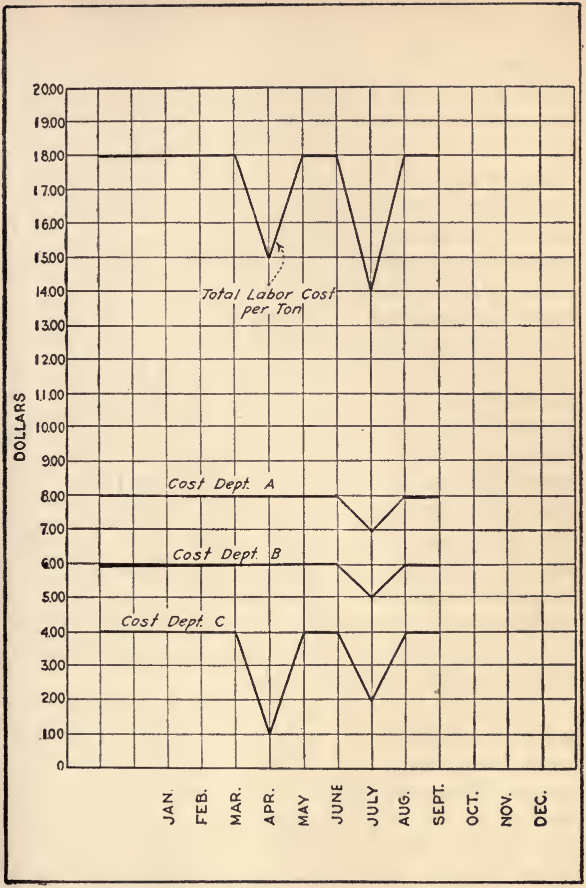


FIG. 9. SHOWING CUMULATIVE EFFECT OF DEPARTMENTAL COSTS UPON THE TOTAL COST.

Experts will tell you that only one or two curves should be shown on one sheet of co-ordinate paper, since otherwise there is likely to be confusion. While this is generally true, nevertheless there are advantages to be gained in certain cases from having all the information in regard to a certain subject placed before the executive at the same time. Note, for instance, representations of unit costs in Figure 9. The important matter is the total cost of production. The curve for this may be placed at the top of the sheet —as shown in the illustration, which presupposes that the labor cost of a product processed in three department, A, B, and C, is made up of the labor cost in these three departments. In both April and May there is a violent drop in the total labor costs. With the three factors shown on one sheet, a glance down the April line shows that the drop in the cost total was due entirely to a drop in the costs in Department C, and that the costs in Departments A and B remained stationary. The executive therefore concentrates on Department C—to find out the cause, in order to make that unusually low cost in April a regular occurrence if possible.

In July there is a drop of $4 in the total cost. The question, of course, is again: In which department were costs low? The graph arranged as illustrated answers the question at once—they were low in all three departments, but principally in C. The executive, then, is at once directed to the proper places for investigation. If it had been necessary to search around on a lot of sheets, considerable time would have been lost and no little figuring might have been

necessary before the relative drop in different departments could have been ascertained. Or worse still, the figuring might not have been done at all, and our executive might have attended to the "fly" instead of to the "fire."

It is desirable to draw the curves, when possible, in such a way that when the major, or control, curves sink, the cause of the sinking may be located at once by direct reference to the minor curves, and when the control curves rise the cause may be forced upon the executive's attention. There is a famous socialistic picture that represents Society dancing upon a ballroom floor which is held up by the sweating backs of toilers—the toilers who produce the wealth which makes the music and champagne possible. In the center of the picture, a group of social butterflies regard with terror the chaos and horrror revealed below through a hole burst in the polished floor by the naked fist a toiler has driven upward in agony. Just so should the control curves be arranged to burst upward when conditions below threaten disaster. The dangerous rise in the cost of one factor must be reflected in the control curves which must rise in proportion to the danger. Similarly, the sum of a number of small rises in the minor curves, reflecting a general condition throughout the business, must be shown by the control curve with sufficient distinctness to indicate the prevalence of a condition that needs the executive's attention.

Graphs and the "Exception Principle."—This brings us to the application of the "exception principle" to the arrangement of graphs. Thus:

Each morning the executive would have placed before him a single graph, a sort of super-control or barometric graph, which would reflect the exact condition of the business up to and including the day previous.

If conditions as reflected by this barometric graph were satisfactory, the executive might safely turn his mind to the consideration of concrete problems of various sorts—such as the betterment of technical processes, the planning of new sales campaigns, or the improvement of his golf game by a trip to the links.

If conditions so reflected were unsatisfactory, he would turn to the next graph, which would show him what department was responsible for the fall of the barometer. Judging from the information he gained, he might conclude that all was well except in that department.

A third sheet would show the detail of the offending department so that the executive could put his finger, as it were, upon the exact spot which was ailing, and then concentrate upon the remedy for the ailment.

Such a plan, if it can be realized—and it very often can, in principle at least—produces the maximum effect with the least possible demand upon the time and energy of the executive. This system sorts out automatically matters that are going satisfactorily, and directs the attention of the management to those that are not, if any. The chief knows every morning that everything is all right, or that everything is all right except—whatever the series of graphs focuses

his attention upon. As a result, he can work—not worry—knowing that everything will have his attention which requires it, and that he is free to concentrate upon the business marked "next" on his schedule. The reduction of the essence of the business to one curve, or even to a single graph, requires a detailed analysis of the business over a considerable period—a matter which will be taken up later.

One of the greatest advantages of this method of judging each morning the state of the business, is the increased fairness it renders possible in the handling of assistants. Altogether, at different times I suppose I have had the following remark made to me by twenty-five or thirty factory superintendents: "We always have a breakdown when we have visitors. I never knew it to fail." As a superintendent myself, I always drew a breath of relief when the general manager had made the rounds and no unusual accident had occurred. When the old methods of forming judgments were used, the general manager's opinion of his subordinates was very often a matter of luck. Accidents always do happen when the boss is around, and if you are unlucky you may be "in bad" to a hopeless extent, while some more fortunate chap, the sum total of whose accidents and inefficiencies are three times yours, may, through luck, gain the reputation of being your superior as an executive. Injustices of this sort are bound to occur when the boss forms his judgment of departmental efficiency as a result of periodical raids, made with the idea of "catching the men at something." Under such a system the management wastes its time and

reaches false conclusions. On the other hand, a system that gives an executive promptly a knowledge of facts automatically presented increases the efficiency both of the executive and of the organization.

Some Special Details.—The mere laying out of curves on paper is of relatively little importance and requires little thought as compared with the observance of the principles I have stated. At the same time, a few more details on the subject may prove of assistance. Having secured the proper instruments and selected the general type of paper, or the sort of card, most suitable, you next have to assemble your figures. The first thing, of course, is to determine the maximum and the minimum figures to be presented—the extremes which have occurred in the past. A knowledge of the business makes it possible to estimate, from these figures, whether the extremes will be likely to remain what they have been in the past, or whether new extremes will be established in the future.

When you have determined safe limits, you must select the scale. If you use the millimeter paper described—which has a very heavy ruling every half-inch and a medium heavy line every quarter-inch—it will be fairly easy to plan the graph, provided you do not try to put too many curves on one sheet. The full fifteen-inch side with its thirty squares, each divided into ten parts, will take from .00 to $3.00 if each square represents one cent, from 0 to $30 if each one represents 10 cents, and so on. Where you are dealing with millions, dimes are not important. But it is important not to try to represent dimes and

millions with the same curve, as you will soon find if you are foolish enough to try. (See footnote.)

It is advisable to use only decimal units when possible. If each millimeter represents a dollar, it is easy to extend and to read the curves. In case of emergency each millimeter may be made to represent a factor of ten—that is, 2 or 5. If you plat a curve with three units to a millimeter, you will regret it.

You should avoid, if possible, using two scales for the same sort of units on the same sheet, since the impression made by a large rise in a curve is likely to be the same, irrespective of the fact that one scale represents dollars and the other dimes. The dollar curve should speak ten times as loud as the dime curve, if the correct impression is to be conveyed to the mind of the reader.

It is about as futile to direct the novice in great detail concerning the exact methods of preparing graphs as it is to try to teach a would-be artist every move to make with his crayon or brush. It is much better simply to explain the principles of the equipment, and then tell him to "go to it." Technique can be acquired only by practice. But the broader the statistician's knowledge of the laws underlying the business, the more eeffctive his work. The executive should select his statistician with care, for upon the latter's interpretation of the facts depends the future of the empire of business.

NOTE:—The reader will understand that the paper described by Mr. Farnham is readily obtainable and is ruled according to his description. The illustrations in this book, however, while originally drawn on such paper, have been redrawn with fewer cross-rulings and to a smaller scale for reproduction purposes.—*Editor.*

CHAPTER VIII

THE ANALYSIS OF THE BUSINESS

First Phase—Bird's-Eye View.—Whether the executive at first elects himself statistician, or whether he appoints one of his assistants to the position, it is necessary that he understand the method of procedure.

The first step is to make a survey of the business, and this survey should be divided into two parts. The first part should be what used to be called, before the days of the aeroplane mapping cameras, a "bird's-eye view." The best time for the executive to make the survey is after a two-weeks' vacation, during which time he has resolutely put the business out of his mind. If he cannot take a vacation, he must find some other method of prying his nose away from the grindstone and thus insuring a proper perspective. The perspective, in any case, is absolutely necessary. If no other means of obtaining it is at hand, a cold blooded examination of the reasons why he is paid his salary may suffice.

Once he has reached the true conclusions he may put the principal factors on paper somewhat in the following order:

I. Dividends.—It goes without saying that dividends—large, regular and frequent—are the reason for the existence of any business, since it is the hope

of an adequate return upon their money which induces the stockholders to invest their capital in the first place. Dividends are directly dependent upon earnings, so that the first leaf in the "Bible" of the executive should show graphically the fluctuations in earnings over the period of the concern's existence.

II. Profits.—Since profits consist in the difference between the selling price and the cost price, the second section should show by means of curves the average monthly selling price per unit of the major products as compared with their total "cost sold." The space between these two curves at all times represents the profit. Low profits may be due either to a low selling price or to a high manufacturing cost. By watching the fluctuations in the two curves the executive can at once determine which of the two halves of his organization needs his attention and assistance, and he can throw his strength behind the weakest point.

III. Sales.—Graphs showing the total quantity of sales, and the distribution of quantities by districts and subdistricts, show the executive and the sales manager just how well each portion of their organization is doing as compared with how it has done in the past, and just which portions of the territory need attention. The prices obtained in each section of the country are averaged each month, and the data is so presented that every effort may be intelligently and consistently made to hold prices to a maximum. In a similar manner sales expense is kept track of, and subdivided as common sense suggests.

In concerns that have applied the principles of scientific management to their sales department—rewarding their salesmen and salesmanagers exactly in proportion to what they accomplish in the matter of quantity sold, price obtained, and expense saved—the "efficiency," or percentage of attainment, of the standard set on these points in each territory is platted so that the eecutive may see at a glance just what is being accomplished in each territory in proportion to what careful analysis of local conditions in each district has determined should be accomplished. This standardization simplifies the work of the executive considerably, since the results obtained from the application of scientific management to the factory—which increases the employees' interest in their work, fosters team play and so on—render less essential the supervision of the chief executive. Moreover, the percentage system of recording results boils down all results to a common denominator, so that the minimum of time is required for him to grasp the exact state of affairs.

IV. Manufacturing Costs.—After making an examination, should the sales graph show that low profits during a given period were in no way attributable to avoidable faults in the sales department, the executive would naturally next turn his attention to the manufacturing department. While it is not my purpose to indicate in detail at this time how a complete cost system may be reproduced graphically, nevertheless I wish to call attention to the following principal questions which the executive probably would be prompted to ask: (a) Was the total cost of manu-

facture high or low as compared (1) with past costs? (2) with the standard costs? (b) Was the output unusually high or unusually low? (c) For how much of the variation in costs was the output responsible? (d) Was a period of low output followed by merely a rise in the indirect labor, supervision, rent, general expense and various other sorts of overhead, or did it extend to the direct labor, showing that men were kept on unnecessarily in slack times by foremen "just to be good fellows"? (The answers to these questions would at once determine the executive's course of action.) (f) Was the variation in cost due to labor or material?

With such questions as these answered—in fact with the answers so arranged in advance that they strike the executive forcibly, unavoidably, relentlessly, and regularly every month—either the executive takes the necessary action, or he cannot avoid admitting even to himself, that he is entirely incompetent.

V. Material Costs.—An increase in the cost of raw material often carries the rise in costs outside the executive's control. Nevertheless he should know exactly to what extent this rise affects his cost of production. Such knowledge drives him either to raise the selling price—and for a legitimate reason—or to attack with renewed vigor some department which seems capable of reducing its operating costs sufficiently to offset the increased material costs. In other words he is driven to make an extraordinary effort to meet the changed condition, by a knowledge of its exact seriousness; and his stockholders can rest

assured that everything possible will be done to safeguard their interests.

Second Phase—Handling Details.—Having selected the essentials of the business and arranged them in order under main captions similar to those just cited, and having decided just what it will mean to the business and to himself if he keeps such essentials always before him, the executive is ready for the second phase of his analysis.

This phase deals with the matter more in detail, but in so far as possible loss of perspective is avoided by emphasis being placed upon the details under consideration in proportion to their relative importance. To illustrate, I shall cite the case of a small sewer-pipe plant, employing about a hundred men, in which it was desired to concentrate the superintendent's attention upon each phase of manufacture, exactly in the order of that operation's importance to the stockholders as a producer of dividends.

The costs, as shown by the simple cost system which existed, were arranged as shown in the accompanying table of cost of labor and material in a sewer pipe factory.

The superintendent who concentrated upon the hauling of coal and ashes and saved 5 per cent of the expense, would save the stockholders $2.25 per month on a 1,200-ton production. If he devoted his attention to saving 5 per cent of the expenditure for coal used at the kilns, he would increase their dividends by $60 a month, or $720 a year. This method of analysis directs the executive's attention to every phase of the business and insures his attention being devoted to

MONTHLY COST OF LABOR AND MATERIAL IN A SEWER-PIPE FACTORY.

Operation.	Cost per ton.	Percentage of total.	Relative importance of operations.
Wages.			
Moving clay-cars to dry pans....	$0.03	0.8	12
Grinding—dry pans............	0.06	1.6	9
Mixing—wet pans..............	0.05	1.3	10
Making—press crew............	0.34	9.0	4
Finishing and drying—floor crew	0.12	3.2	7
Setting—floor to kiln...........	0.25	6.6	5
Burning—burners and firemen..	0.20	5.4	6
Hauling coal and ash—carts and horses	0.03	0.8	12
Kiln cleaning—cleaning........	0.02	0.5	13
Drawing—kiln to yard or cars..	0.25	6.7	5
General labor—miscellaneous....	0.10	2.7	8
Repairs to buildings...........	0.03	0.8	12
Repairs to mach'y and equip't..	0.07	1.9	9
Repairs to kilns...............	0.04	1.1	11
Repairs to tools................	0.01	0.3	14
Superintendence	0.12	3.2	7
Total labor................	$1.72	45.9	
Supplies.			
Repairs to buildings............	$0.04	1.1	11
Repairs to mach'y and equip't..	0.05	1.3	10
Repairs to kilns...............	0.10	2.7	8
Repairs to tools................	0.01	0.3	14
Miscellaneous supplies..........	0.07	1.9	9
Stable—labor and supplies......	0.05	1.3	10
Clay—cost at storage..........	0.50	13.4	2
Kiln coal—cost in bunkers......	0.80	21.4	1
Steam power—labor, coal and supplies	0.40	10.7	3
Total supplies.............	2.02	54.1	
Total Labor and Supplies...	3.74	100.0	

each factor in the exact order of that factor's importance.

The same method should be used by the executive in conducting the survey of any business, whatever its size may be. It should be remembered that the purpose in introducing any innovation, large or small, is to add to the ultimate earning power of the business. Furthermore, it should always be kept in mind that the executive exists to maintain and to increase the earning power of the stockholders' capital. He must therefore survey the business with this fact in mind in planning to control it more scientifically by the use of statistics set forth in graphic form.

Once the essentials of a business have been determined and the order of their importance has been fixed, the executive is in a position to direct the preparation of the graphs which shall set forth conditions as they exist. Before taking up departmental detail and indulging in specific illustrations of just how control is effected in special cases, I will endeavor to show how the essentials of a hypothetical business may be graphically arranged so as to facilitate scientific administration, and how future conditions may in a measure be predicted by means of standards set as a result of the study of past conditions.

A Set of Typical Graphs.—The cost of assembling the data, and of keeping up a set of graphs which bring all the vital facts of a business regularly and promptly before the executive, is not great. The amount of detail which it pays to present in this form depends upon the type of business covered. It

has been my experience that the initial expense of installing the system is paid for many times over almost immediately by the saving involved in decreasing the number of inefficiencies. The full system should generally be kept up for a year or two while the laws underlying the fluctuations in sales, costs, and other important factors are being codified; thereafter it is often possible to boil down the system to a few vital, or key, curves whose fluctuations tell the whole story to the executives who have become familiar with the exact cause underlying each effect.

An exceedingly able executive of my acquaintance has boiled down the essential data of a business of several millions a year so that they are set forth on one sheet of very minute curves which he keeps under glass on his desk. He has used the system for six or eight years, and has discarded one by one the more elaborate curves as he has educated himself in the laws upon which his business is founded, until now the whole system of statistics is reduced, comparatively speaking, to thumb-nail dimensions.

The pages immediately following—accompanied by Figure 10, showing the first series of typical graphs —describe the method of placing the facts of a hypothetical business before the executive in sufficient detail to enable an intelligent cost accountant to proceed with the work, once the executive has decided upon the points of his particular business which it is important for him to know. The second series of curves—Figures 11, 12, and 13—shows the method of setting graphic standards in the same detail.

"Net Profit" Graph.—Figure 10 shows the "total net

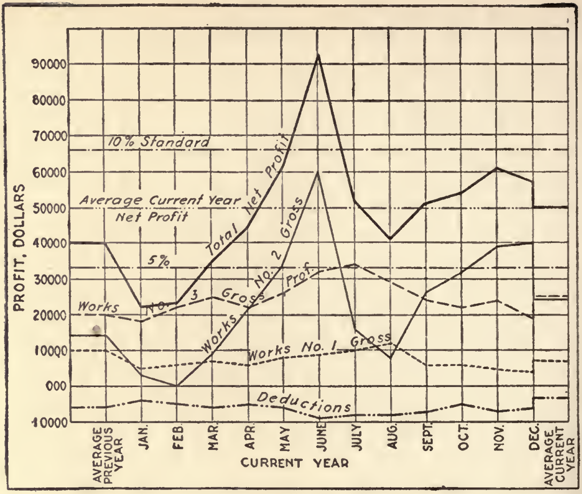


FIG. 10. TOTAL NET PROFIT—STANDARD NET PROFIT—SOURCE OF PROFIT—DEDUCTIONS FROM FACTORY PROFITS

profit'' accruing from the business each month, in comparison with the standard of 10 per cent set as a proper return upon the investment. The average for the year is also shown in comparison with the average net profit for the year previous. The lower broken line represents the danger point, below which the ''net profit'' curve should not be allowed to fall if adequate return is to be earned.

The sources of the net profit are shown by the three central curves marked Works No. 1, Works No. 2, and Works No. 3. These represent the three factories of the company, whose earnings are given in

terms of gross profits. From the aggregate represented by these curves is subtracted each month the amounts represented by the lowest curve, marked "Deductions," which include interest, discount, commissions, and any other amounts not easily pro-rated to the proper factory. The balance consists of the amounts shown in the "Total Net Profit" curve.

The executive, in making use of this graph, as it is filled in monthly during the year, would have the variations in the net profit forcibly and unavoidably brought to his attention, in such a way that investigation and the consequent maximum improvement would, under the circumstances, inevitably ensue. If the "Net Profit" curve drops suddenly, as it does in August, it is simply necessary to follow the August line down to note that the profits from Works No. 3 were normal—they were well above the previous yearly average; that profits from Works No. 1 were also normal; but that there was a sharp falling off in the profits at Works No. 2. He need not, therefore, concern himself for the present with conditions anywhere except at Works No. 2.

Similarly, since it is necessary to analyze all abnormal conditions carefully in order to avoid in future those that are unfavorable and to make permanent those that are favorable, the rise in the net profit curve in June, when investigated, would show that Works No. 2 was the principal source of the additional profit; conditions at Works No. 1 were normal and at Works No. 3 only slightly above normal. The executive may therefore conclude that there is greater need for careful analysis of operating conditions at

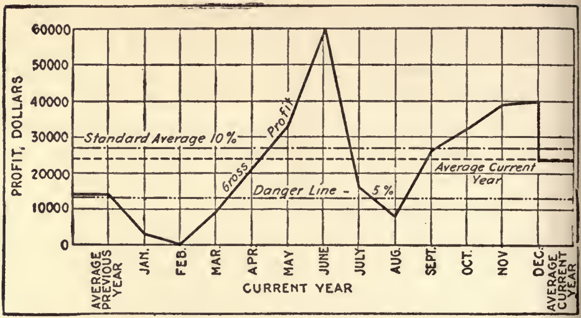


FIG. 11. GROSS PROFITS ON WORKS NO. 2—STANDARD PROFIT AND AVERAGE PROFIT FOR PRECEDING YEAR AND CURRENT YEAR

Works No. 2 than at the other plants in order to employ its profitable features in the other plants.

Analysis of Fluctuations.—Since the rise in profits in June, and the fall in August, were at Works No. 2, their causes must be obtained by reference to the first chart in the second series, Figure 11. The graph shown there keeps the executive informed at all times just how closely the profits at this particular factory approximate the standard earning previously set—in this case, 10 per cent on the investment—and warns him at once if the earnings fall below the 5 per cent danger line. This graph is merely a refinement of the one shown for Works No. 2 in Figure 10. It is valuable principally because it shows more exactly just how serious the variation from the normal is, indicates what its effect will be on the year's earnings, and emphasizes the urgency for attention.

It will be noted that the June profit reached \$60,000—an amount more than twice the \$28,000 required to earn the 10 per cent; while in August this factory made a return of only \$8,000—or \$5,000 below the 5 per cent danger line.

The causes for these fluctuations must be sought on the next graph of the series, Figure 12. There the upper pair of curves show the "Selling Price" by months as compared with the total "Manufacturing Cost" at Works No. 2. The lower curves show by months the factory's tons of output as compared with tons sold. In each case the final monthly average for the year is shown at the right, and the monthly average for the year previous is shown at the left.

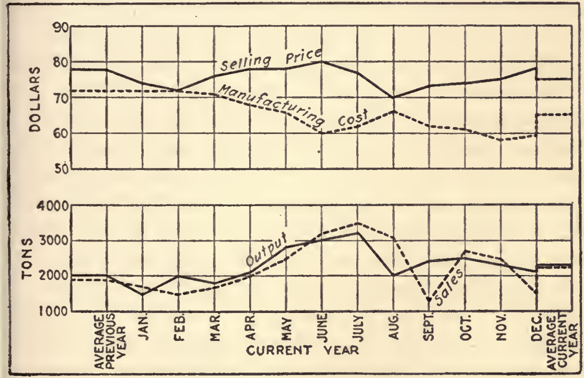


FIG. 12. SELLING PRICE VERSUS THE MANUFACTURING COSTS AT WORKS NO. 2—OUTPUT VERSUS SALES—AVERAGES FOR PRECEDING AND CURRENT YEAR

The profit earned at any factory is, of course, the difference between the prices received for each unit when it is sold, and the cost to manufacture this unit, multiplied by the total number of units made, or the factory output. The difference, then, between the "Selling Price" and "Manufacturing Cost," multiplied by the number of units shown any month, gives the factory profit for that month.

It should be noted that there are, of course, certain adjustments that must be made according to the requirements of each business, since very few concerns would sell during the month all goods made that month, while still fewer would have no goods in process of manufacture at the end of each month. We have assumed in this case, however, that these unusual conditions existed, in order to avoid a long digression concerning methods of taking inventory.

Carrying the analysis of the abnormal profits in June and in August to this graph, the executive is at once able to determine whether the variation is due to market conditions or to manufacturing conditions, and is thus enabled to give his support to the sales department or to the factory. The "Selling-Price" curve reaches in June the high point for the year, $80, although that is only two dollars above the average for the previous year. This showing is favorable, but not sufficiently removed from the normal to demand immediate attention. The "Manufacturing-Cost" curve shows a decided drop below any point reached so far durng the year, and reaches a point twelve dollars below the previous year's average. Evidently the increased profit is due to

manufacturing conditions, which must be investigated in order that the gain may be made permanent if possible.

If August conditions are analyzed in a similar manner, it will be found that the falling of profits \$19,000 below the standard set is due about equally to the drop in the selling price and to the rise in the manufacturing costs. The first suggests to the executive an investigation of selling conditions; the sales manager may be asked to report fully on the reasons for the fall in prices. The second leads the executive to turn to the next graph, Figure 13, which deals with operating costs at the factory. (It should be noted that the "Sales" curve in Figure 12 is shown to indicate how sales keep up with the production. Sales-analysis graphs are described elsewhere.)

Fundamental Factors.—Figure 13 comprises three sets of curves. That at the top shows the monthly output in tons; the two curves in the center show the direct-labor cost per ton and the indirect-labor cost per ton; while the curve at the bottom shows the material cost per ton. Monthly averages for the year under consideration and for the previous year are shown at the right and left respectively.

On this sheet the executive gets fundamentals, and by careful analysis of the conditions and their effects he can deduce the general laws underlying his own particular business.

For instance, take the low manufacturing cost in June, shown on the previous chart. The output is 500 tons (or 20 per cent) above the average. We should naturally expect that a drop in the indirect cost per

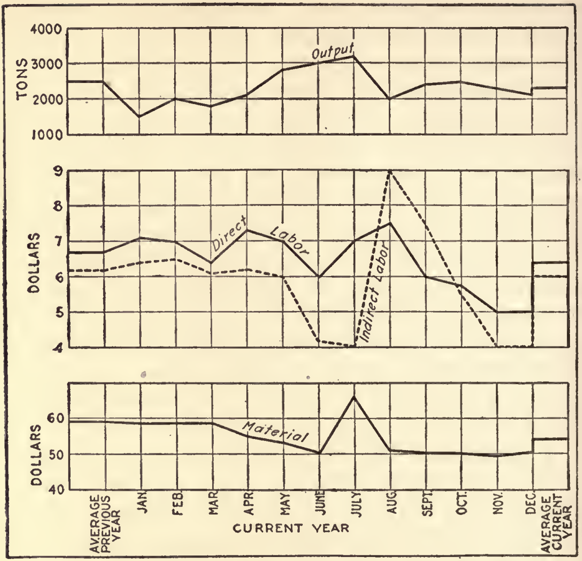


FIG. 13. OUTPUT—DIRECT AND INDIRECT LABOR COST PER TON —TOTAL MATERIAL COST PER TON

ton would follow, since the fixed charges would remain nearly constant while the divisor (the output) increased. We find this to be the case, if we refer to the dotted curve, which shows a reduction of $2.20 per ton, 33 per cent below the average indirect cost per ton for the previous year.

It is to be noted also that other factors in the cost-reduction were a drop of about $0.70 in the direct labor, and of $9 in the material cost. This latter cost,

quite likely, is beyond the control of the executive, but it must be shown in order that he may not take the credit for a low cost when the saving is not attributable to anything his organization has done, but to market conditions. If this cost were not shown, he might naturally neglect certain departments in which the cost of production is rising and which consequently need attention. In other words, such matters as are the business of the executive must be put squarely up to him in such a way that he cannot overlook or neglect them.

Applying the Remedy.—Concluding, then that the June cost-reduction under his control is due to indirect and direct labor, the executive investigates, first, the methods of maintaining a large output. His research eventually leads him to a consideration of the sales department and to an investigation of market conditions. Incidentally, he would consult graphs in order to discover the increase or decrease in such items as general expense and sales expense, and to make certain that there is no waste, and that no extraordinary opportunity for economy is being overlooked.

The drop in direct labor in June leads to a perusal of the graphs covering the various departments and the cost of each operation therein. If direct labor costs are either low or high, there is a definite reason, and the executive must not rest until he has made the gain permanent or corrected the fault responsible for the rise in cost.

I have not attempted to carry the illustrations into further subdivisions here, because doing so would

very shortly have brought us from the field of general principles to that of the particular business, which it is not my purpose to treat at this time. I believe enough has been said, however, to illustrate the method; greater detail will be given later. But to analyze a month in which costs are high, I shall take the month of August, when the costs were some dollars higher than in June. What strikes us first is, of course, the jump of about five dollars in the indirect-labor cost. This we may lay to the decrease of a thousand tons in the output—caused, let us assume, labor costs rose also. The reason may be determined by a fire in one of the largest departments. Direct-by reference to the department graphs. The executive might find that the rise in cost was due to the disorganization incidental to, and following, the fire; or that the labor involved in the repairing and cleaning up was charged against operation, instead of to extraordinary expense as it should have been. Such matters must be investigated, and from the conclusions drawn exact methods must be evolved for future guidance.

Economy is effected through the knowledge of exactly what the disaster cost in operating expense, in loss of output, and so in profits. Complete analysis in this case would lead the executive, when he discovered that his loss of output had cost him $52,000 profit, to take steps of the most decided nature. (Compare June and August, Figure 11, after noting that material costs were nearly constant, with the same months in Figure 13.) Fire extinguishers would be put in, a sprinkler system would be in-

stalled, an employees' fire department would be organized, or a fire-proof building would be erected, and thus such a loss would be prevented in the future. It is much easier for an executive to obtain appropriations for needed preventives if he can show his directors exactly where the disaster touched the pockets of the stockholders, than if he has to rely merely upon arguments.

Relationship of Curves.—I have indicated the economies to which an analysis of particular months may lead. It remains for me to show the advantage to be gained by analyzing one curve showing conditions over a considerable period, and noting the effect of other conditions upon it. The effect of the output upon the indirect labor may be taken as an illustration. In the previous year the factory above considered had a moderate output of 2500 tons per month and a moderately high indirect-labor cost of $6.20 per ton. During the early months of the current year the low output incidental to the season kept the charge of indirect labor hovering around $6.50. As the output jumped in June and July, the indirect-labor cost dropped over $2 per ton. The accident in August took it up to $9, and it was not until October that it approached $4 again. The output apparently was not enough larger, however—since it was 700 tons less than in June—to account for all of this drop.

The reasons for that drop would have to be sought in graphs covering various sorts of overhead expense. The tendency, however, is very clear, and the executive can determine exactly the effect output has upon his profits, and can plan ways and means that

will carry the business over seasonal slumps. After studying this phase for a year or two, he is in a position to determine exactly how much he can afford to cut prices at certain seasons of the year in order to keep the factory busy to capacity at all times. It was consideration of just such factors as this which a few years ago led some of our larger corporations to dump a certain portion of their product in foreign countries—an action that obtained wide publicity and brought caustic comment from such economists as were socialistically inclined. The principle is a sound one, but if disaster is to be avoided there must be knowledge of the limits permissible.

The "Direct Labor" curve must be examined in connection with the departmental curve. Careful study of this curve over a period leads almost inevitably to the standardization of labor conditions. The fall in the "Direct Labor" curve shown in Figure 13 would have to be ascribed to some such cause as that. The general tendency downward in the "Material" curve would be caused to a great extent by a fall in the cost of raw materials, although a considerable percentage of it might be due to the standardization of materials and the awarding of a bonus to employees to encourage the elimination of waste.

In general, it can be said of these various curves that the fluctuations of any one of them are indefinably associated with the fluctuations of each of the others, and that it is only by close study of the effect of one upon the others over a considerable period of time that the executive can make sure of

obtaining maximum results in the way of low operating costs, large sales, and ultimate profits.

Setting Standards—Profit.—It is only after making a thorough and detailed study of past conditions that the executive is in a position to set standards to be attained. The following graphs, Figures 14, 15, and 16, illustrate a method of effecting this standardization. The standards set were based, in each case, upon a hypothetical analysis of conditions assumed to prevail during the year shown by the series of graphs presented in the preceding pages. In Figure 14 it will also be noted, I have shown the actual year's accomplishment—merely for the sake of convenience, to illustrate the method of procedure. I have found that thorough standardization has resulted, almost without exception in a much closer degree of attainment than that shown.

Figure 14 shows the profit that must be earned each month at Works No. 2 in order that this plant may bear its share of the 10 per cent return on the investment which has been set as a standard net profit for the corporation as a whole. The broken line, marked "Standard," represents the cumulative earning which an analysis of selling and manufacturing conditions has shown to be a reasonable attainment each month. Thus, the gross profit from this factory should be $24,000 for January. By the end of February this profit should have grown to $52,000; by the end of March to $81,000, and the increase should have gone on in this proportion.

The solid line, marked "Actual," shows how near to the prescribed standard the year's conditions would

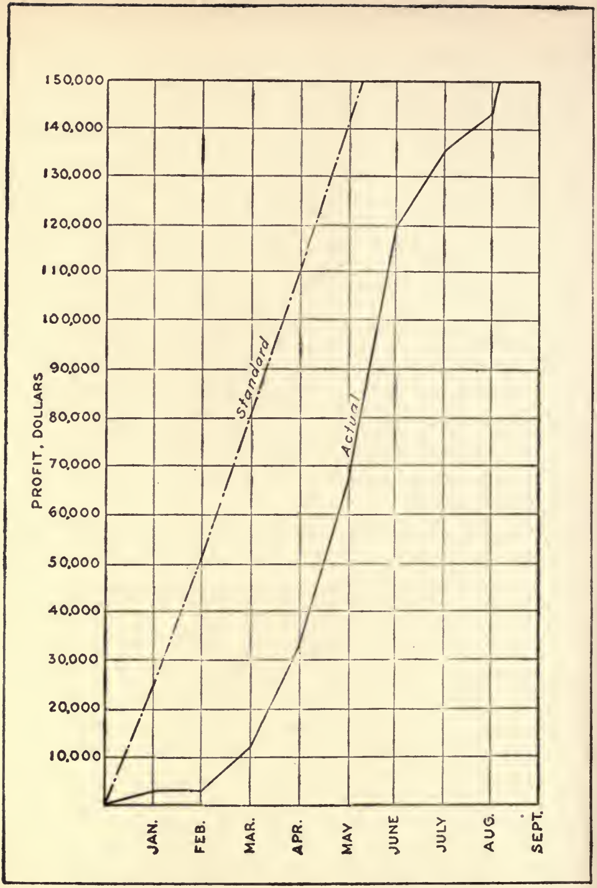


FIG. 14. STANDARD VERSUS ACTUAL PROFITS CUMULATIVE BY MONTHS

have allowed the actual profit for that year to approach. It will be noted that at the end of February the actual profit was $49,000 below the standard, and that by May it was $76,000 short of the standard, and so on.

Selling Prices.—It is obvious that in order to set a standard profit it is necessary only to determine for each month a standard selling price and a standard manufacturing cost per unit, and to multiply the difference between these by the figure representing the standard output. The difficulty lies in the standardization of factors composing the cost, selling price, and other items. I shall discuss the method of determining these as I proceed. It should be noted, however, that the profit has been standardized to bring in—allowing for seasonal fluctuations—at least enough to secure the 10 per cent return on the investment which has been set as the standard earning for the company.

Figure 15 shows, by means of the diagonal broken line marked "Standard Returns," the cumulative amount, by months, to be received from sales. The solid line shows the actual receipts for the year. The standard sales price per ton set for each month is shown by the curve at the top of the chart—the cumulative average is represented by the broken line and the individual monthly averages by the dotted line. Similarly, the curve below shows how closely the monthly selling prices for the year approached these standards.

The matter of standardizing selling price is a difficult one. In some cases it is manifestly impossible

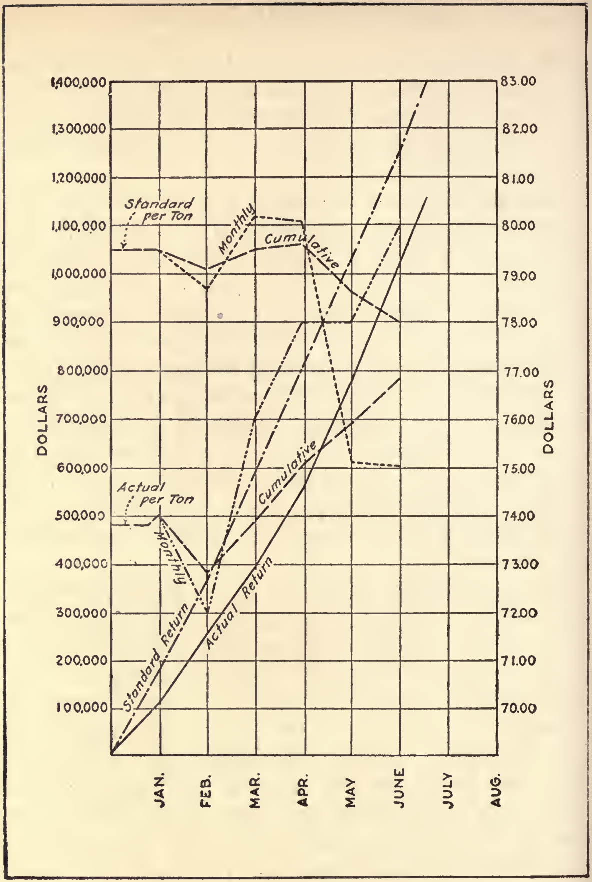


FIG. 15. SELLING PRICES—CUMULATIVE AND MONTHLY
The scale at the left indicates monthly and cumulative totals; at the right prices per ton.

to set a price any length of time in advance at which the goods should be sold. We must remember, however, that in every business there is some one in authority who does set the selling price, and that he sets this price before the sale is made. We should remember, also that the more past data—call it the product of experience, or what you will—he has in his possession, the more intelligently he can set this price, the longer in advance he can predict market conditions, and therefore the more he will obtain for his goods.

Such is the principle. The application varies with every business. I have in mind at the present writing instances of three widely divergent types of business—types in which the keenest competition prevails, in which there are considerable general and seasonal market fluctuations, and in which the selling price is set months in advance—and I know that these concerns are all living up to the standards set with a regularity and precision which, to the uninitiated, would at times seem positively uncanny.

The "bonus for salesmen" system, which I have already mentioned, is a decided aid in the standardization of the selling price. This system makes it directly to the financial interest of each salesman and sales manager to maintain the selling price and the quantity of sales, and to keep down the selling expense, by rewarding him exactly in proportion to the effect of his efforts as regards the ultimate profits of the firm. The system also tends to diminish materially the many and specious reasons for cutting prices which are advanced by salesmen on commis-

sion, and by salesmen who think their promotion depends upon the quantity of their sales alone. It tends, too, very materially to steady the market.

Just how far ahead the sales price can be standardized depends upon the particular business; the question must be settled by each concern according to circumstances. The further ahead the executive tries to look, however, the more proficient he becomes. The more exact his data on past performances, the more likely he will be to make accurate predictions. The mere fact that he has set up a mark to shoot at will tend to bring him a goodly number of bull's-eyes. A rise in the average selling price, other things being equal, is inevitable—and an increase in the net profits is also certain.

It will be noted that Figure 15 shows a standard selling price of about $79 for January and February, which is raised (it is assumed) for March and April to cover an anticipated rise in the price of certain raw materials, and which is later lowered to cover a drop in the market. Actual conditions for the year, in the curve marked "Actual," do not even approximate the conditions predicted, either in the selling price per ton or in the return from sales.

Output.—It should be understood that in standardizing the selling price the firm places no restraint upon prices, unless it be decided that it is to the interest of the firm in the long run not to exceed a certain maximum price. In the particular instance illustrated by the graphs, the selling price was standardized simply at a figure high enough above the standard of production so that the difference

would, when multiplied by the standard output for the year, yield sufficient profit to earn the standard return of 10 per cent on the investment. By comparing the actual selling price, then, with this standard, the executive can find out at any time, at a glance, how nearly he is earning his standard profit.

For an illustration, notice the month of May: Reading the cumulative diagonals, the executive observes that he has received $770,000 from sales during the five months, whereas he should have taken in $1,200,000. Further, he finds that he has sold his product, so far, at an average price of $75.90, while he should have averaged $78.60 for the five months. In addition, he notes that his May sales brought him $78 per ton—and he expected to receive $75.10 per ton. In short, he can tell at a glance just how well he is doing in any particular month and just how much he is behind schedule—and how much he must manage to boost prices during the remainder of the year if he is to make his standard profit. There is no question that such knowledge spurs a man to greater effort.

Figure 16 shows, in cumulative form, the standard output determined upon, and the close approximation of that standard by the output of the current year.

In order to establish a standard profit, the executive must determine upon a standard output. He must know the number of units that must be made—and sold—as well as the standard selling price, in order to attain the standard profit. An examination of former production curves has shown him that the factory can, when pushed, turn out, say, 3,200 tons

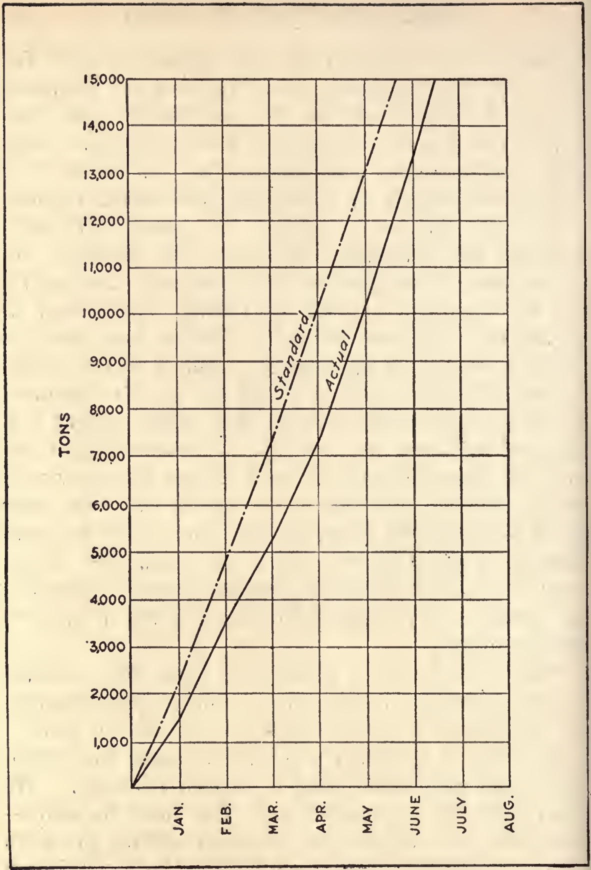


FIG. 16. STANDARD AND ACTUAL OUTPUT—CUMULATIVE

a month (Figure 13). He has further determined from his sales curve that, unless he is prepared to stock heavily, it is unwise to make more than 2,200 tons in January, 2,500 tons in February, 2,700 tons in March, and so on. He standardizes his output accordingly, so that his cumulative production at the end of April should amount to 10,200 tons. Reference to his standard-output graph (Figure 16), then, would show him that by the end of April he has made 7,400 tons and is 2,800 tons behind schedule, and that he must make up the deficiency by the end of the year if he is to secure his standard profit.

Manufacturing Cost.—In Figure 17, the diagonal broken line shows the standard prescribed as the cumulative expense to be incurred for manufacture at Works No. 2. The solid line shows how little difference there was, as the year progressed, between the manufacturing expense for the year and this predetermined budget.

The curve at the top shows the actual cost per ton by months and also in terms of cumulative average. The lower curve shows the standards set. The other factor in determining the profit—besides selling price and quantity sold—is the manufacturing cost. The standardization of manufacturing cost usually implies the introduction of scientific management in the factory. It is not my purpose to enter here into a lengthy discussion of this phase of the matter. Briefly, however,—assuming that he has determined what his product should cost—the executive would would find by reference to this graph in May, for instance, that if this factory had turned out the stand-

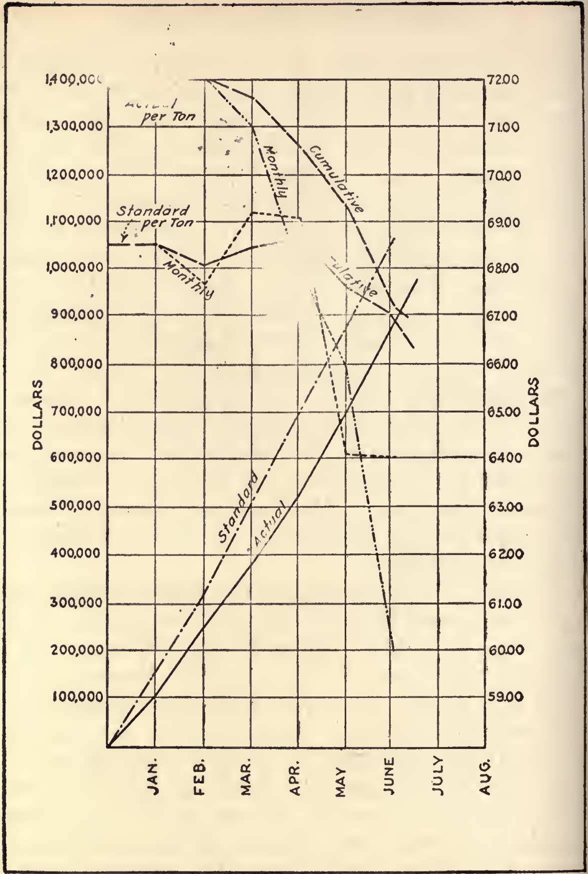


FIG. 17. TOTAL MANUFACTURING COST
The scale at the left shows total expenditures; that at the right expenditures per ton.

ard output at the standard cost, the expenditure would have been $880,000. The solid diagonal line shows, however, that actually only $700,000 has been spent. We have already seen that the factory failed on the output. Reference to the cost curves at the top of the chart, which show the cost per ton to manufacture, discloses the fact that the average cost per ton during the first five months of the year was $69.30—it should have been $67.65—and that the May cost per ton was $66 as against a standard May cost of $64.10. Again the executive knows just how much behind he is, and just how much must be accomplished if the business is to earn the standard profit.

This manufacturing expense, and cost per ton to manufacture, is shown, subdivided into its elements, in Figures 18 and 19. Figure 18 shows, in cumulative form, by the diagonal line, the monthly expenditure set as the standard for direct labor at Works No. 2. The solid line shows the year's expenditure. The curve at the top of the page shows by months the actual cost per ton of direct labor, and also the cumulative average as the year progressed. The lower curve shows the standard cost per ton for direct labor. As has been stated, the standardization of manufacturing costs is dependent largely upon scientific management, and the direct-labor costs are still more dependent upon it. The cost of each operation must be standardized by means of analytical time-study, and a bonus must be offered so that it will be to the interest of each employee to attain this standard.

The graph under consideration brings out the ap-

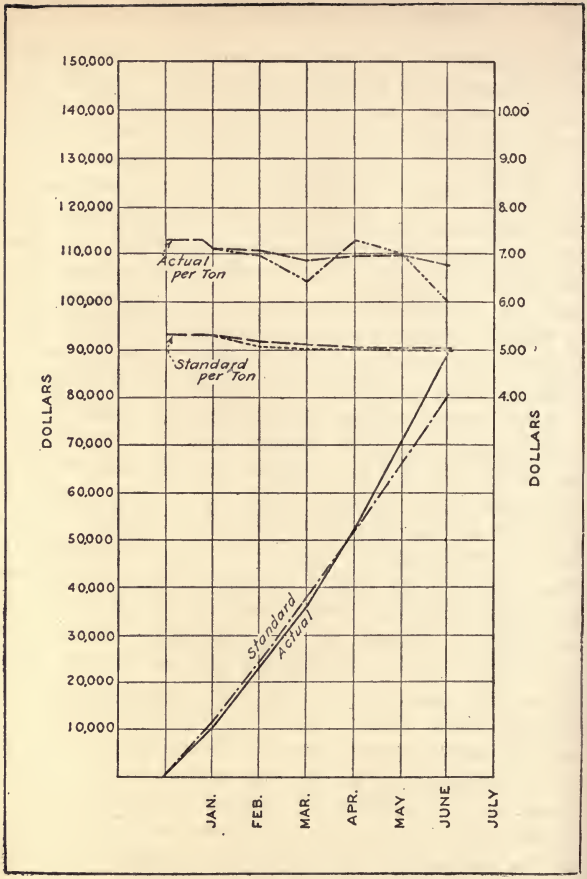


FIG. 18. DIRECT LABOR EXPENSE

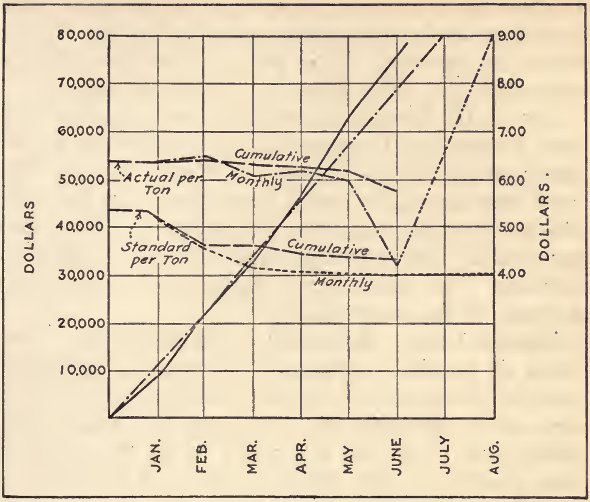


FIG. 19. INDIRECT LABOR EXPENSE

parently anomalous fact that it is quite possible to obtain a satisfactory standard cost per unit of manufacture, even if the profits are unsatisfactory, when too little money is being spent for manufacture. It will be noted that by June the actual cost per ton, cumulative, has reached $67.20, within $0.10 of the standard set (to earn 10 per cent profit), but that only $900,000 has been spent, though $1,600,000 should have been spent for manufacture. The cause of this seeming inconsistency would later be found to be a drop in the cost of material. This drop reduced the manufacturing cost and necessitated a cut in price,

so that the margin of profit did not increase sufficiently to sustain the profit when the output did not reach the standard. It is just such obscure relationships that are made clear by the use of graphs.

Figure 19 shows, in cumulative form, by the diagonal broken line the monthly expenditure set as the standard for indirect labor at Works No. 2. The solid line shows the actual expenditure for the year. The curve at the top shows by months the actual cost per ton of indirect labor, and also the cumulative average. The lower curve shows the standard cost per ton set for direct labor.

Indirect-Labor Standards. — Indirect-labor cost, when all possible inefficiencies have been eliminated, is largely a matter of output. The executive, in this case, after studying the curve, would perhaps conclude that, since the low mark of $4 per ton had been reached in July with an output of 3200 tons, it would be reasonable to suppose that such a cost could be maintained continuously, if the factory could turn out 3200 tons a month. As a matter of fact, he knows from a study of past years that the market will not take over 2200 tons in January, but that by March it should be taking 2700 tons a month, by June 2900 tons, and so on. He feels, however, that by thoroughly overhauling the works, introducing more efficient methods of organization—in brief, by adopting all possible means of efficiency—he can reduce this overhead to some extent. He, therefore, places his indirect-labor standard at $4.05 for the busy season, when, he believes, the market should absorb 2900 tons. In the spring, when the market is good for only 2800

tons, the indirect-labor cost is raised proportionately and is standardized at \$4.10, rising to \$4.20 with a 2700-tons standard output in March, to \$4.60 in February with 2500 tons, and reaching the high point of \$5.20 in January with its 2200 tons standard.

Once the indirect-labor standard has been figured out in this way, the executive is in a position to decide whether to cut prices and maintain output, or to maintain price and let the output fall, since he is in a position to know, almost to the dollar, just what every ton drop in output will cost him.

The setting of accurate and attainable standards depends upon the preparation of records which are exact and which can be easily assimilated. It is necessary to go much further into departmental subdivisions than has been indicated here, to make accurate predictions. I have attempted only to indicate the way with a few generalities, since the illustrations can be only general unless a specific business is discussed.

Given the organization, the executive who has his business before him—as a modern general has his battlefield before him, accurately mapped to scale—is much more likely to predict exactly and to bring about the outcome he desires, than the man who depends merely upon his intuition and upon the uncorrelated data he happens to remember. And the executive who, like the modern general, is prepared, is the one who will win his fight upon the battlefields of business.

CHAPTER IX

EFFICIENT SELECTION AND CONSERVATION OF LABOR

The Executive's Raw Materials.—Before the future can be predicted with any degree of certainty it is necessary, as has been stated, to analyze the past in considerable detail. The general laws which govern business must be understood, and the laws which are peculiar to the particular business must be discovered and codified.

In the last chapter I endeavored to show the target, as it were, at which the executive who would administer his business scientifically, must aim. Before he can hope to blast from its dugouts the inefficiency which has intrenched itself in the business under the guise of "casual methods of management," he must understand not only his ammunition and his gun, but also the laws of trajectory and of impact. In the following chapters I shall endeavor to describe in detail the materials with which the executive must work, and the machinery at his command together with its action and its effect upon the efficiency of the business.

It may seem trite to say that the raw materials with which the executive must work are labor and material, but special emphasis may well be laid upon the fact that in final analysis his success will depend upon the sureness of touch with which he moulds

these two elements into the symbol of victory which the business that he controls represents for him. The machinery with which he shapes these raw materials successfully consists of his organization and his methods of control. The action of this machinery depends upon the care and intelligence with which it is built into the business, and its effect depends upon this and upon the consistency and skill with which it is used by the executive.

Labor- and Material-Conservation.—The method of attack in the case of the usual business which has grown up under casual management consists, first of all, of a survey of the labor and of the material. Two questions are asked:

1. Is the labor employed efficiently? (Efficiency of selection, efficiency of conservation, efficiency of supply, and efficiency of use are involved.)

2. Is the material being wasted? (Efficiency of purchase, efficiency of conservation, and efficiency of use are involved.)

Skilled engineers have estimated the labor efficiency of the business which is considered well run—according to the usual standards in industrial America—at from fifty to seventy per cent of the standards that are attained after the application of what is known as scientific management. As a matter of fact, the regularity with which the efficiency of the usual "well run" business falls between sixty and seventy per cent of such standards becomes almost appalling in the eyes of those who have made a number of industrial surveys.

The labor efficiency in the poorly run business is often only twenty-five or thirty per cent. When you go through a factory and find men operating one heat-treating furnace, when the proportion of the heating up to the quenching time was as six to one, and when these men could just as easily have operated five or six; when you find aluminum being cut at speeds and feeds low enough to machine the hardest steel—and with the same sort of tools; when you find sheet-metal blanks being punched three times on three different machines when a properly designed die would have made all three punches at once—then you can easily believe such statements.

When you add to inefficiencies of this sort time lost through lack of power, lack of material, lack of proper tools at the proper time, lack of definite instructions, in fact, lack of all the things that make it possible for the operator to perform continuous work—and then add to such causes of interruptions the lack of incentive caused by wages being the same, whether time is spent working or waiting, you know, if you have trained yourself to observe actual conditions, that existing conditions are not in the least overstated.

Add to all this the inefficiency of wrong use of labor, the inefficiency shown in the selection of labor which, until very recently, prevailed in nearly every industry in the country, and then on top of that pile inefficient labor-conservation—and it is no wonder that we have had to add fifty per cent tariff duties to foreign-made goods to keep our factories running.

Selecting Labor.—It may seem trite to say again that the employer should exercise care in selecting his labor. But most great truths are simple. It used to be said that the great strength of Lincoln lay in his ability to "think through" a complicated question and then reduce his conclusion to a few simple words which even the most unlettered could understand.

Frederick Palmer, in his last book on the great European war, makes these statements:

> One can never make the mistake of too much simplification in the complicated detail of modern tactics, where the difficulty is always to see the forest for the trees. The higher you go in the command, the simpler seem the plans which by direct and comprehensive strokes conceal the detail which is delegated down through the different units.

So it is with business today; one half of industrial efficiency consists in the exercise of care in the selection of labor.

The tendency has been—just as in the case of the executive described in a previous chapter—to take what comes rather than to go after what is needed. A great many heads of corporations will not admit this. They will tell you that they use a great deal of care in selecting their employees; just as six out of twelve concerns, operating without an organized employment department, in reply to a recent questionaire stated that their men were hired by the superintendents. The average number of workers in these six concerns was 840. If you figure a labor turnover of 400 per cent, which is not at all unusual in this day and age, each one of these superintend-

ents hired eleven men each working day. Even if he devoted no more than fifteen minutes to each applicant, he spent nearly three hours a day (or at least a third of his time) on the men he selected, to say nothing of the time he spent interviewing the men he rejected. If you accept the manufacturers' statements as accurate, the least you can do is to sympathize with their superintendents!

The Problem Underestimated.—The first step in intensive labor development is identical in principle with that in the old-time receipt for "jugged" hare—"First catch your hare." In other words—first, get your labor. The average manufacturer may maintain that it is difficult to exercise discrimination in the selection of his labor when he cannot get enough of any sort to enable him to run his factory to capacity. He might as well argue that a man drowning in deep water would not have been more likely to save himself if he had acquired the art of swimming in shallow water. The time to learn to swim is when circumstances are favorable. If a man does that, he will have a chance when the boat upsets in the middle of the stream. Just so in building up his labor to resist the exodus to the farms in the harvest season, or to the munition plants in time of war, the man who has hand-picked his labor before the crops are ripe or before wages soar skyward, will have a greater chance of preserving his organization than the man who "takes what comes to him" and consequently finds himself totally unprepared for the emergency.

If the average manufacturer would exercise one quarter of the care in selecting his labor that he does

in purchasing his material and supplies, we would hear a great deal less about labor troubles. Nearly every business of considerable size has a purchasing department, but until recently an employment department was a rarity. Men speak with admiration of "a shrewd buyer." But how often do we hear of a shrewd hirer of men? And yet labor cost is more than half the production cost in countless corporations. Occasionally some man in the forefront of business progress, like Stone or Armour, will have something to say about the selection of employees, but more often it is the captain of industry's pet theory of selecting assistants which is discussed rather than the selection of labor in general. The rule of one such for success was, "Select your office boys, and your managers will select themselves," but such a rule applies to only a small proportion of the men hired in any sizeable industry and may not extend to the large laboring element.

Perhaps it is our inherited Yankee trading instinct which makes us place undue emphasis upon the purchase of material. More likely the error has been due to the fact that the gain secured by beating down the price of a material two or three cents is easily computed, while the gain from spending two or three hundred dollars a month in order to purchase labor efficiently is less easily seen. Furthermore, specifications covering material are prepared with greater facility and the purchased units are more easily compared with the standard when the commodity belongs to the mineral or vegetable kingdom than when it belongs to the animal kingdom.

Common-Sense Tests.—I hold no brief for those who advocate the selection of labor by phrenological test or according to the color of the hair. There are certain common-sense tests, however, which are of great value. If you are selecting employees for work where quickness is essential, it is possible to devise tests under which candidates will show their natural aptitude in this respect. Ordinarily this is work for the trained engineer, although a certain amount of selection along common-sense lines is possible if its necessity is kept in mind continually. Only a fool would pick out a brewery horse to go fox-hunting with, and the man who is doing the hiring can avoid selecting human percherons and St. Bernards where Arabians and fox terriers are needed.

For instance, there are definite standards for speed in stenography. Any girl who has any business whatsoever to attempt to sell her services, even, as a novice, should write forty to fifty words a minute from her notes—and yet I suppose that not ten per cent of the thousands of girls who are hired every year are ever timed. The result is thousands of hours lost by expensive executives, in training girls to a particular job for two or three weeks, only to find at last that a mistake in selection has been made. Ten minutes spent in the first place with a stop watch, and the candidate would have been sent back to the business college—which would have been best for the girl and best for the public. Tests quite as sensible have been devised for other varieties of activities—the difficulty has been to get employers to "bother with such folderol."

Employment Manager Needed.—If the employer of more workers than he can know personally would examine the situation thoroughly and analytically, he would find that he could not afford to be without an employment manager, or at least he would realize that he needs a man who can combine employment management with other duties. Consider for a moment the prevailing conditions in the industry employing 840 men, mentioned earlier in the chapter. Any one who knows anything about those concerns which state that "the superintendent does all the hiring," knows perfectly well that that overworked individual isn't giving any three hours a day to examining the eleven successful applicants, and another six hours to examining the twenty-two unsuccessful applicants, in addition to the time he gives to his regular duties. (I assume that only one out of three men is fitted to the particular job open on the day in question.)

What generally happens is this: Somewhere about the front door of the factory is a timekeeper, or some other overworked clerk, who is principally interested in completing his daily stint of figuring and getting down to the poolroom, or the movies, or wherever else his real interest in life lies. As men apply for work he grunts at them, if they are few—or if they are many and interrupt his work, he hangs out a sign "No men wanted."

Pretty soon the superintendent returns from his morning round and observes that Bill or Pete needs a man in his department. The next two-legged specimen that is able to drag itself up to the door is sent

out in the works to hunt up Bill or Pete. As the candidate wanders about the plant in search of the vaguely described foreman, he furnishes a pleasant diversion for the other employees as he makes inquiry of countless workers, who are only too glad to stop and chat for a few minutes. Eventually he reaches Pete or Bill. Pete is very busy and doesn't interview our human derelict—merely sets him to work—or else he spends ten or fifteen minutes, which he should have devoted to something else, talking to the wanderer in a desultory and pointless manner. Pete is a good foreman, but he is not a trained employment investigator. On the other hand, if our pilgrim is not hired the performance just described must be repeated, until a man arrives who suits Pete's fancy and mood at that particular moment.

If labor is scarce and the "No men wanted" sign has given way to a different placard, reinforced by newspaper advertising and extra money given to the employment agencies, we generally find Pete and Bill out scouting for labor at such times as they are not frantically endeavoring to "make both ends meet," as it were, in their department. In any event, somebody is devoting time to hiring new employees. Whoever is doing so is taking time from his regular duties and is doing work for which he is neither trained nor fitted. The results, therefore, must necessarily be more expensive to the company than if the work were performed by a trained man. The employer pays—whether he knows it or not—and the more the defect is covered up, the more it costs in the end.

Importance of the Position.—The important thing is not so much to have an elaborate employment department, organized along set lines, as it is to devise some system which is simple and systematic and which fits the particular case under consideration. It may be that the business is large enough to justify engaging an employment manager with his staff. Concerns employing four and five hundred men do feel that they can save money by having an employment manager with a clerk and a stenographer. If the business is too small for that, however, the chief dispatcher, or even the timekeeper, may add the work of interviewing applicants to his other duties. Such work is sometimes advantageously combined with welfare work. The exact title of the man who does the work is of no consequence. The important requirements are a suitable temperament, real interest in the personality of the workers, tact sufficient to draw out the man being interviewed, a sense of justice, and a fair share of that instinct which is known as "the ability to read character." The type is quite distinct from the foreman or superintendent type, and for that reason it is better not to combine employment with executive work.

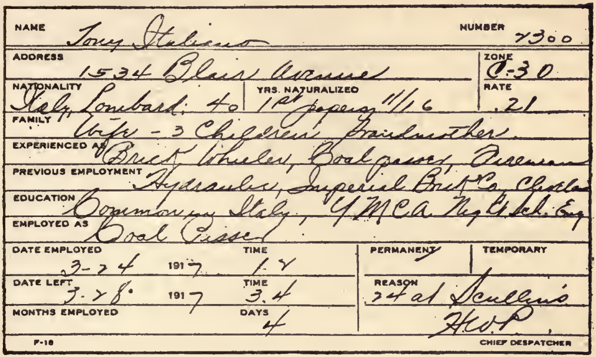
It is important that the right sort of man be selected, not only in order that the work may be done effectively, but also because the only way the rank and file of our modern industrial armies have of sizing up the men at the head of our great corporations is by judging such of the great man's representatives as they come in contact with. Their first impression is gathered from their interview with whoever hires

them, and their last from the man who finds out why they are leaving. The first impression is important, as it is likely to color their future relations with a company, and their last because the name they give a company in the labor world often depends upon it.

Suppose the work of hiring new employees is placed under the control of the chief dispatcher in a business which is organized along modern lines, but which is not large enough to afford a regular employment department. The dispatch office is always more or less a clearing house for labor, taking care of the man not needed by one department and furnishing an extra man to another. Besides, new men must be registered and numbered at the dispatch office, and men leaving must give up their numbers, ring out, and secure a time certificate in order to be paid off. If such an arrangement does not work out to advantage, perhaps the work can be taken over by the timekeeper's office, although that department is not usually located as close to the firing line, and therefore is not possessed of as much exact information in regard to individual workmen as the dispatch office.

Questioning the Men Tactfully.—The first duty of the man selected is to take stock of the labor on hand. For this purpose a simple register card has been devised. The information must be secured tactfully, as the following extract from a newspaper in a large city shows:

> More than 200 ornamental glass workers walked out on strike yesterday morning at various factories of the ——— Co. when they refused to sign "efficiency cards" giving their social condition, names, and other personal data.



NAME Tony Italiano NUMBER 7300
ADDRESS 1534 Blair Avenue ZONE C-30
NATIONALITY Italy, Lombard: 40 YRS. NATURALIZED 1st papers 11/16 RATE .21
FAMILY Wife - 3 Children Grandmother.
EXPERIENCED AS Brick Wheeler, Coal passer, Fireman
PREVIOUS EMPLOYMENT Hydraulic, Imperial Brick Co. Cleveland
EDUCATION Common in Italy, Y.M.C.A. Night Sch. Eng.
EMPLOYED AS Coal Passer
DATE EMPLOYED 3-24 1917 TIME 1.4 PERMANENT ✓ TEMPORARY
DATE LEFT 3-28 1917 TIME 3.4 REASON 24 at Scullin's
MONTHS EMPLOYED DAYS 4 H.W.P.
F-18 CHIEF DESPATCHER

FIG. 20. APPLICATION CARD

Laboring men are suspicious of any innovation—especially workmen from countries where registration means police surveillance. A simple explanation should therefore be made of the possible value to the employee of the information asked. Mystery always stimulates the imagination. Just as the neighbors always concoct a story to explain the house with the drawn blinds, so does the working man suspect the worst if no explanation is forthcoming. The widely prevalent stories of "black bottles" kept to finish undesirable patients at the hospitals, and other "romances" of a like nature testify to this fact.

Note the card shown in Figure 20, for instance. If all the questions are fired at a man in the curt and rasping tone of the desk-sergeant at a police station, we cannot blame him if he objects and gives as good as he takes. It is unnecessary, and at times

dangerous, to ask a man whether he is black or white. It is much better to judge his color and age, and then to make to him simple statements like the following: That his address is desired in order that his family may be reached in case of possible sickness or injury; that his birthplace is desired, together with information in regard to naturalization and education, in order that the local Y. M. C. A., or other organization interested in his welfare or in his eventually becoming an American citizen, may get in touch with him; that the questions in regard to dependents is prompted by a desire to favor in slack times those who need work the most; that the company desires information in regard to his previous experience in order to be able to place him to its own and his advantage, and so on. The day has gone by when the boss could know every one of his employees intimately and personally. The next best thing is a registration card, which gives the boss certain vital facts in regard to each man, and allows him to examine statistics and from them and from his broad knowledge of human nature to issue certain edicts that will benefit the employee as well as the employer.

Applying the Golden Rule.—The man of broad and deep experience knows that there is such a thing as the higher selfishness. "Honesty is the best policy" is one of its lower laws. It is the law which, though we may not realize it, makes us courteous in public. Imagine society with every man elbowing his neighbor at every street-car stop and congestion point. Roughs who have not learned this law are taught it in summary fashion. "Live and let live" is an old-

fashioned expression of it. The far-sighted employer treats his labor well for his own sake. The intelligent laborer plays fair with his boss and is benefited in the end.

In one form or other, you may be sure, the employer who elbows his employee ruthlessly aside, sooner or later receives the bloody nose just as the rough on the street-car does; and the working man who does not realize that his own and his employer's interests are eggs in the same basket, sooner or later finds that he has made a mistake that brings bitter results. The more thorough the understanding between employer and employee, and the greater their personal knowledge of each other, the better for both. Neither can exist without the other, and the sooner each has this fact brought home to him directly and personally, the better for both.

Welfare work in reason and "Safety First" movements are more than self-supporting. But in welfare work care must be taken that the worker's independence is not interfered with. There is a great difference between interference and helpfulness when applied to another man's mode of living: the one is tolerated only through fear or favor and is greatly resented, the other takes the form of a kindly suggestion and is usually gratefully received. Personal cleanliness and decency can, of course, be made compulsory, but to go beyond that requires tact.

Filling Out Register Cards.—The following Standard Practice Recommendation which has been handed to clients in several instances covers filling out register cards in detail:

STANDARD PRACTICE RECOMMENDATION.

WHEN PROPERLY COUNTERSIGNED THIS RECOMMENDATION BECOMES A WRITTEN ORDER TO ALL WHO RECEIVE A COPY.

SUBJECT: STANDARD PRACTICE FOR FILLING OUT REGISTER CARDS.

In order to make clear exactly what it is desired to have the Chief Dispatcher enter upon the Employment Register Cards, the following Standard Practice Instructions have been prepared:

Register Card.

1—At time of interview enter applicant's full name, address and rate. Zone can be filled in later.

For the present, zones are as follows:

W—15——15 minutes or less walk from work place.
C—15——15 minutes or more ride to car from work place—up to
C—30——30 minutes or more ride on the car from work place—up to
C—45——45 minutes or more ride on the car from work place—up to
C—60——60 minutes or more ride on the car from work place.

2—Under *Nationality* should be entered the country and the city, state or province in which the applicant was born, together with his apparent age. Tact should be exercised in securing this information. The nationality can be determined by the answer as to state or province of birth, and the age can be judged within 10 years, which is close enough.

3—Under *Family* should be entered information in regard to dependents. In case objection is expressed to answering this question, it should be explained at once that the information is desired for the workmen's good, as those with families would naturally be favored in slack times.

4—Under *Experience* enter the exact sort of work the man has done in his last two or three jobs. It is better for him and better for the Company that he do something similar to what he has been doing, wherever possible.

5—Under *Previous Employment* give names of last two or three concerns for which applicant has worked.

6—Enter as much detail as possible in regard to each applicant's *Education.* If he has some education his chance of advancement is better, and if he has none there are local organizations which can help him.

7—Under *Employed as* enter the job to which he is first assigned.

8—The entry under *Date and Time Employed* is obvious.

9—*Permanent* or *Temporary* should be checked according to the interviewers' judgment. Construction work and repair work is often known to be temporary. Work in the regular manufacturing departments will be assumed to be permanent.

10—Under *Date Left and Reason* should be entered from the Pay Off Slip the date and time the connection is severed and the principal reason for leaving.

Card properly filled out should appear as shown in Figure 20. These cards are to be retained at the Dispatch Office and filed alphabetically in the Drawer marked "Employed." When a man leaves, his card should be transferred to the "Left" drawer. No cards shall be filed until initialed by the Timekeeper who shall call at the Dispatch Office at specified times, at least once a day. The Timekeeper is not authorized to enter any names on the payroll without the order which a properly filled-in Register Card signed by the Chief Dispatcher constitutes. Violations of this rule must be reported at once.

Pay-Off Slip.

This pink slip which serves as an order upon the Timekeeper to remove from the payroll and to pay off an employee who is leaving, is to be made out by the Chief Dispatcher. The Timekeeper is not authorized to pay off any one whatsoever unless such an order is presented properly signed.

The Pay Off Slip (Figure 21) is to be made out in duplicate, by means of a carbon, down to the space marked "Reason." The original is then torn off and initialed by the Chief Dispatcher, to serve as the employee's order upon the Timekeeper for his pay.

Before this is given him, however, a full explanation of just why he is leaving should be secured, if possible, and entered on the second sheet.

ORIGINAL

TO THE TIME KEEPER:-

PLEASE PAY OFF AND REMOVE FROM THE PAYROLL:-

NAME Tony Italiano

DEPARTMENT NO. P. P. MAN NO. 2300

WORK

DATE QUIT WORK 3-28 1917 TIME 3.4

REASON

HWP.

F-19 CHIEF DESPATCHER

DUPLICATE

TO THE TIME KEEPER:-

PLEASE PAY OFF AND REMOVE FROM THE PAYROLL:-

NAME Tony Italiano

DEPARTMENT NO. P.P. MAN NO. 2300

WORK Coal Passer.

DATE QUIT WORK 3-28 1917 TIME 3.4

REASON Didn't like job - could get .24 at Scullin's. Tried to persuade him to wait for job as Kiln Fireman.

HWP.

F-19 CHIEF DESPATCHER

FIG. 21. ORIGINAL AND DUPLICATE OF PAYOFF SLIP

This will of course require tact and judgment, especially in the case the man is quitting after violent disagreement with some one in authority. Whenever the circumstances permit, an effort should be made, however, to reach the real cause of the man's leaving. Where this is impossible the reason given should be written in quotation marks. Later, before the Register Card is transferred from the "employed" to the "left" drawer the reason for leaving should be condensed to a word or two and entered in the space provided. The carbon copy should be attached to the Register Card by a clip before filing.

If there is any reason at any time why these instructions cannot be carried out to the letter, notify the Industrial Engineering Department at once.

Yours very truly,

____

Engineer.

DTF:G.

Copies to L. T. V.
R. S. P.
T. L. Q.
Supt.
C. Desp.
T. K.

Reduction of Labor Turnover.—The cost of breaking in a new employee has been variously estimated at from $40 to $120 a man. Any employer who doubts this need only recall his own early blunders to be convinced. One man—an engineer pre-eminent in his line—who was at first inclined to doubt, finally recalled his first job, an apprenticeship in a power plant. "Yes," he said, "come to think of it, I guess I did cost my boss something. The first week I was there, I turned a valve the wrong way and let fifteen hundred dollars worth of oil run into the river. I guess you're right."

Suppose a factory employs 800 men when running to capacity. A labor turnover of 400 per cent has not been at all uncommon in some years. Suppose it costs only $50 to break in each new employee. Then this turnover, which involves putting on 3200 men during the year to maintain the normal working force of 800 men, is costing the company—in broken tools, spoiled material, extra supervision from foremen and fellow-workmen, loss of output and delayed orders—$160,000 per year!

If intensive labor development will reduce this labor turnover to 200 per cent, the saving to the company will be $80,000—an amount certainly worth going after. The reduction of labor turnover is comparatively easy if a company is willing to adopt the Henry Ford plan and pay double or triple the prevailing wage rate. But the engineer or executive who would have the temerity to recommend such a course to his company would today risk his popularity, to say the least. The only course open to him, then, under ordinary circumstances, is to devise ways and means to secure for those who have entrusted their capital to him a low labor turnover at the least possible expense. This means a careful analysis of the situation and the formualtion of a labor policy which must be adhered to in spite of temporary discouragements.

Some Important Axioms.—After the company's employees have been registered upon the cards and the information has been tabulated, the axioms almost formulate themselves. Notice the anwsers given to the questions on the Register card, then:

1. Other things being equal, hire and also endeavor to retain in slack times the man who has a family. He needs steady work more than the floater, he will stay when the other drifts away, and he is less likely to be frequently absent.

2. Give preference to the man who lives close to the factory. If he can walk and save ten cents a day—$30 a year—he will remain with you instead of going elsewhere on the first rumor of a five-cent raise. If he lives on the other side of town, he may be taking a job with you until he can get one closer home. The working man doesn't enjoy getting up an hour earlier just to spent it in a crowded street car, and getting home late for dinner, any more than the boss would. Men who live out in the country for the sake of the health of their families are often an exception to this rule, and are generally very desirable workmen. It is best, however, to select suburbanites who live on your side of town, where possible.

3. The province or state a man comes from often determines his adaptability to certain sorts of work. It has been said that the Pullman Company picks its star porters almost from a certain county in a certain Southern state. Italians from Lombardi are entirely different in physique and in temperament from those born in Terramina or in Palermo. Ambitious negroes who have saved sufficient to bring their families north are quite different from the "coke-ridden" floaters of a great northern city. A colored gentleman said to me only a few days ago "Ah did'n like dat place. All coons look alike to dat boss. He doan' know how to

treat a good nigger.'' Any man who has tried to put Turks and Greeks on the same crew, or to put an Irish laborer under an Italian foreman, won't make the same mistake again. The only way the finer points of differentiation—which are the most important—between the various nationalities and between men from various sections of the same country can be learned, is to study them. Such study without knowledge of the provinces from which your men come, is obviously out of the question. The man to whom Bulgarians and Roumanians are all ''Rooshians'' is obviously at a disadvantage in selecting men to become ultimately a co-ordinate and permanent working force. Exact knowledge, as well as time and patience, is necessary to complete success.

4. Men are usually better satisfied to do work to which they are accustomed. If you know what a man can do you are not only more likely to keep him, but you are less likely to have it cost you so much to break him in. If he is versatile in your line you are insuring, to some extent, several jobs by hiring him.

5. Information in regard to previous employment gives you a certain line on his training, and in case of need furnishes a reference as to character and ability.

6. Information as to naturalization and education leads to the more remote, but just as sure, benefits which are gained through what is generally known as welfare work. The National Chamber of Commerce has recently asked that even more questions of this sort be asked to awake the foreigner's interest in American citizenship. In the larger cities there

are Y. M. C. A. and settlement workers who are only too glad to look up the ignorant and to instruct them. A great many labor troubles are due to the alien's misconception of the American employer and of American institutions, and nothing is so conducive to a clearer understanding than a knowledge of English and an interest in citizenship.

7. Information as to why a man quits is invaluable. It shows just what wages are tempting the force away, and why employees are leaving certain departments. One employment man said to me a while ago, "Oh, I never listen to their hard luck stories." He little knew how he was throwing away one of his most valuable assets as an employer, an asset that might have led to the discovery of grafting foremen and of petty tyranny costing the company thousands a year because men "split the swag" and held back on work out of revenge—he might even have prevented serious labor troubles.

Reaching Desirable Workers.—As soon as data can be compiled covering a period of a number of months, it should be arranged graphicly for analysis. Before I take up that feature, however, I wish to emphasize one other point—that of laying the foundation for a reliable source of labor supply. The men you find hanging around labor agencies and saloons during periods of labor shortage are not the men you want when you are in need of workmen. If you have a list of married men living near your plant whom you have registered as desirable, at a time you had no work for them, you are quite likely to be able to replenish your force greatly to your own and to their

advantage if you have means of getting in touch with them. The following Standard Practice Recommendation illustrates one means of accomplishing this:

STANDARD PRACTICE RECOMMENDATION.

WHEN PROPERLY COUNTERSIGNED THIS RECOMMENDATION BECOMES A WRITTEN ORDER TO ALL WHO RECEIVE A COPY.

SUBJECT: WAITING LIST.

Whenever there are more applications for work than positions open, it is a good plan to list the names and addresses of applicants so that the search for labor may be made in a definite direction when men are needed. A list of applicants to choose from also makes it possible for a company to select the most desirable men and the men best fitted to the positions open.

At the present time more men are applying for work than are needed. We, therefore, recommend that the information usually entered at the Dispatch Office upon a Register Card (Figure 20) when a man is placed on the payroll be entered also in the case of applicants for work, and that the card be stamped "APPLICATION. O. K..........." and placed on file.

Whenever a man is needed by a foreman of any department, the application considered most suitable should be O. K.'d and the workman notified by means of a multigraphed notice reading somewhat as follows:

....191..

In answer to your application for work we wish to say that we will be able to use you as .... at $.. per day. If you still desire a position please call at the .... Factory at 8 a. m. .... morning.

NATIONAL STEEL CO.,
Per ....

Yours very truly,

DTF:G. ....

Copies to H. C. D.
T. L. P. V.
P. C.
R. S. P.
T. D. T.

A Useful Application Blank.—I include here also a specimen application blank for technical or clerical positions, to illustrate the difference in the sort of knowledge of an applicant which it has been found desirable to have when accumulating a waiting list of a different sort. This has been designed not only in order that the executive may have certain data on file, but also that he may judge, to some extent, an applicant's intelligence from the way he answers the questions.

I have known men to put up a very good front during the few minutes they were interviewed, take the blank home with them, and send it back next morning with the startling information that their height was "5 feet" and their weight "10 inches." Some men have modestly stated that their complexion was "good." Very few notice the "time held" feature of line 15. The question in regard to overtime, line 31, brings forth some very illuminating answers. Put yourself in the frame of mind of the man to whose interest it is to give the answer desired and yet who wants to be honest, and see.

File No. ...... Classification ......
Date .... 191..

AMERICAN WOODWORKING CORPORATION

APPLICATION FOR TECHNICAL OR CLERICAL POSITION.

Please answer the following questions in your own handwriting:

1 Name ....
2 Address ....
3 Nationality ....Complexion..............

Date of Birth, Month....Year....Height....Weight...
Single or Married..........Number Dependent.......
Position preferred..................................
Can you speak any foreign language..................
How much time have you lost by sickness during the last five years?............................
Nature of illness?..................................
In what places have you lived?......................
What position do you now hold?......................
How long have you been so engaged?..................
Reason for seeking change?..........................
Describe two previous positions, giving firm name, time held, general duties performed......................
....
What education have you had?........................
....
What studies did you enjoy most?....................
....
What least?...
Did you work during your vacations?........What did you do?...
What are your favorite recreations?.................
....
What athletic sports have you ever indulged in?.........
Are you studying now?........What?................
Can you manage people well?....State the evidence?
....
How do you feel about working overtime?.............
Do you make acquaintances rapidly?..................
State names, occupations and addresses of three persons you care to give as reference.......................
....

The method of bringing before the executive the data compiled from the labor register cards is illustrated by the following charts and the explanation of them that is given.

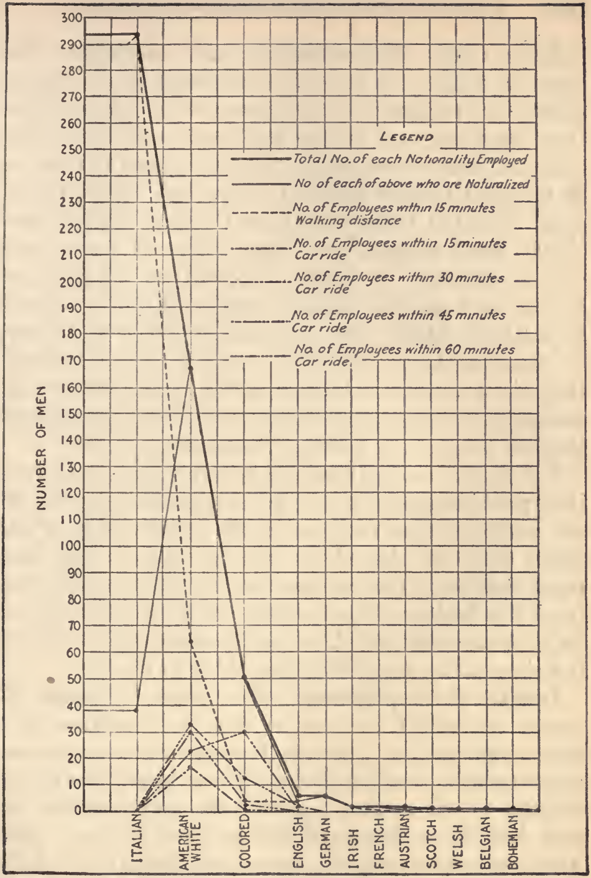


FIG. 22. NATIONALTIES, NATURALIZATION, AND RESIDENCE OF EMPLOYEES

Nationalities, Naturalization and Residence.—The chart in Figure 22 shows the nationalities, naturalization and residence of employees in a typical plant. Over fifty per cent of the total employed were Italians, and there were about twice as many of them as of the next largest national group, the white Americans. Colored labor amounted to about 16 per cent of the total payroll, and other sorts of labor were very scattering. It should be noted that only about 12 per cent of the Italians were naturalized. Such an analysis might well cause an employer uneasiness in times of labor shortage, since it would indicate that his destiny was largely in the hands of a single nationality whose representatives did not understand English enough to become American citizens.

The lower broken lines help to explain why the Italians predominate. It will be noticed that nearly all are within fifteen minutes' walk of the plant, while about half the Americans are an hour's ride, and more than half the negroes are half an hour's ride, from the factory. The remedy, then, would seem to be a systematic effort to bring closer to the plant the classes that are second and third in the list.

Length of Employment.—The chart in Figure 23 shows the length of time various nationalities have been employed at a certain factory—in other words, their relative staying power under local conditions. It will be noted that most of the total number of men had been employed within ninety days. The American whites seem to be the most recent comers in large numbers, most of those employed having arrived within thirty days.

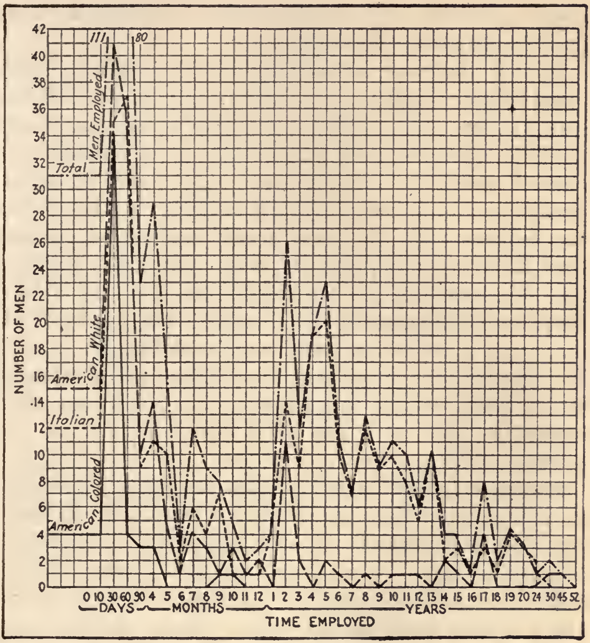


FIG. 23. LENGTH OF EMPLOYMENT BY NATIONALTIES

The majority of the Italians are shown as having been employed about sixty days. Seasonal conditions seem to have thinned out those Italians employed over four months and under twelve months, while there is a certain faithful band, which had been with the company from two to fourteen years.

The colored Americans are all shown as recent comers. This would seem to indicate that lack of

housing nearby kept away all except floaters in more or less desperate circumstances.

One of the most interesting things shown by this chart is the loyalty of a few old employees—American, Italian and colored—some of whom had been with the company over forty years. The general conclusion would be that an intensive study of labor conditions would be necessary in order to determine the reasons why the more recent employees, at the time the chart was prepared, were continually moving on. The space in the lower right-hand corner of the Register Card would in time answer this question. A disease is more easily cured once it is diagnosed, and the reasons why employees are leaving are symptoms which soon lead to the discovery of conditions that cannot be ignored if the labor turnover is to be reduced.

Monthly Labor Turnover.—On the chart in Figure 24 a state of affairs is illustrated which is not uncommon in industrial centers—especially in factories employing large quantities of unskilled labor. It is noticeable that the turnover amounted to only about 100 per cent until spring came. When railroad and outdoor work began, the turnover jumped to nearly 600 per cent. There it remained until midsummer. The August harvest then shot it up to 700 per cent, after which labor began to dig itself in for the winter. In November, general wage raises started the turnover up again by attracting labor to other factories. This condition was met in the factory under discussion by a wage raise which brought the turnover in December down again.

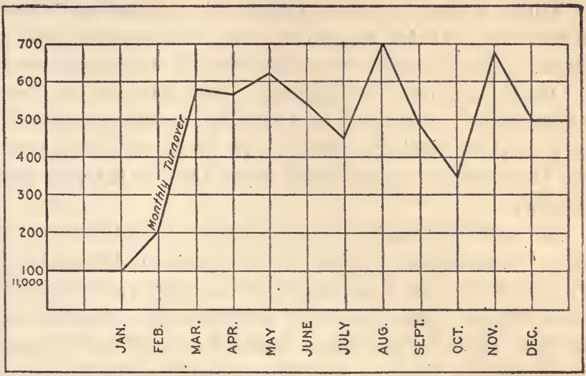


FIG. 24. TURNOVER BY MONTHS

In some of the more progressive cities manufacturers are comparing their labor turnover statistics through the medium of local organizations formed to promote mutual efficiency. Such figures as the following are most illuminating.

Firm.	1st Year's Turnover.	2nd Year's Turnover.
1—A Machine Tool Company..	207%	86%
2—A Coke & By-Products Company	89%	57%
3—A Steel Products Company.	203%	159%
4—An Automobile Manufacturing Company...........		455%
5—An Automobile Part Company		305%
6—Another Automobile Company		129%
7—An Automobile Body & Specialty Company.........		635%

These figures cover a period of expansion in the motor-car industry when turnovers were exceptionally high. The difference in turnover in the same sort of business should be noticed. The fact that the first three firms reduced their turnover is significant. It is a striking fact that No. 1 was much more successful than No. 3, even though their lines of activity are similar.

An extraordinarily high turnover usually means that "something is rotten in the State of Denmark." In one firm that I investigated, a turnover fifty per cent higher than in other corporations engaged in similar work in the same district, was finally found to be due to the fact that the superintendent had an arrangement with a local employment agency whereby he received twenty-five cents for every man hired. A short time before he departed rather hurriedly, it was found that he was firing men in batches simply because of his understanding with the agency. In this way he had raised the turnover enough above what it should have been, to cost his company something like fifty thousand dollars a year—to say nothing of the untold suffering he had caused the families of employees unjustly dismissed—merely that he might realize a few paltry hundreds. When the labor turnover is abnormal it is imperative that the executive investigate. He is unlikely to investigate unless the facts are brought to his attention—hence the vital necessity of such charts as we have illustrated.

Departmental Turnover.—Once the executive has determined that the turnover is abnormal, further analysis is in order. The next step is the analysis

of the departmental labor turnover. The presentation of the facts does not, however, by any means solve the difficulties. A high rate of turnover in a department may mean, for example, that the work is particularly hard, that the workmen are underpaid, or that they are unfairly treated. Conversely, a low turnover rate may mean high wages, an easy boss, a department manned by derelicts who haven't enterprise to move on, loyalty of old employees, or a particularly fair and able foreman.

The local demand for each sort of labor also plays a large part in the rate of change, as do working conditions (safety, light, air, temperature, etc.), housing conditions (the opportunity to obtain cheap rent within walking distance among congenial neighbors), commissary arrangements (local stores, lunch rooms, boarding houses, etc.), amount of welfare work (insurance, pensions, profit-sharing, baths, recreation fields, club houses, etc.), and care in selection (giving preference to men with families, who are not floaters, and exercising care along the lines usually followed by organized employment departments). Turnover statistics, in other words, merely disclose existing conditions and indicate the most profitable lines of inquiry.

In one case that came to my attention, a certain rather small department in a large automobile-part factory, when departmental statistics were prepared, showed a very low turnover. The investigator immediately hastened off to this department to discover, if possible, the means employed by this super-foreman to retain his men. The department itself pre-

sented no very unusual appearance, except that it was extraordinarily inefficient and extremely sociable. Something was finally said to the patriarchal Teuton in charge, who cleared up the mystery as follows: "Vell you see, dey are most of dem nephews or cousins of mine or of my wife's—all dot ain't sons of mine. I got dem dier chobs, und I treats dem right, und dey stays." The low turnover was explained, but the crestfallen investigator could hardly hold up such wholesale nepotism as a shining light to less successful foremen, in order to illumine the way to a low labor turnover.

Such a chart as that which is shown in Figure 25 merely points the way to further investigation. The highs and lows should be investigated first. The reasons given for leaving should be classified upon

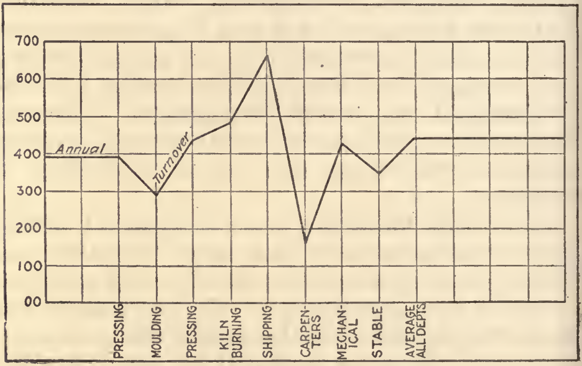


FIG. 25. LABOR TURNOVER BY DEPARTMENTS

the payoff slips, and statistics and charts should be prepared which shall show just why men are quitting the departments where the turnover is great. The executive must, of course, supplement such information with personal investigation, or with investigation by trained men—and must under such circumstances, as always, exercise a liberal amount of common sense.

The departments in which the turnover is low are not so easily analyzed by means of statistics. More investigation upon the ground is usually needed in such cases. Once the reasons are discovered, however—provided they indicate real efficiency upon the part of the departmental executive—an analysis of such qualities will furnish ample material for those "heart-to-heart" talks with which the efficient executive is always encouraging his aides.

Once such absurdities as that cited in a recent paragraph, have been disposed of, charts showing the turnovers by departments can be posted where the foremen can all see them, and a sense of personal pride can be developed, which, perhaps together with a bonus for the attainment of a low turnover, will materially reduce a fertile source of loss to the company.

The Safety of Employees.—An important accessory in the reduction of turnover is the safeguarding of employees. The advantages to be gained are perhaps best set forth in the following Standard Practice Recommendation, which sets forth the humanitarian and financial benefits which arise from the safe-guarding of employees.

STANDARD PRACTICE RECOMMENDATION.

SAFEGUARDING EMPLOYEES.

The Safety First Movement is not only popular and humanitarian, but it is also directly productive of returns commensurate with the investment, for the following reasons:

1. The Factory operated with the safety of its employees in mind may secure a lower insurance rate from a Casualty Company than the factory notoriously careless. It is practically certain to assist in lowering the class rate when the inevitable Employers' Liability is state law.

2. A factory well known for its consideration for its employees' safety can more safely carry a limited policy (which costs less) in the Casualty Company than the one in which conditions are such that their bare statement to the jury insures the limit in the way of a verdict.

3. In case of serious injury to an employee officials of the Company are liable to arrest and the business is liable to serious interruptions and losses.

4. Public sentiment usually demands the reinstatement of any injured employee as soon as he is able to return to work. Cripples and semi-cripples do not increase efficiency of plant operation.

5. Frequent injuries to employees interrupt the work and lower the morale of the operating force. This costs money. We therefore recommend:

a. A thorough investigation of the Company's insurance policies with a view to determining the direct return which can be secured by putting the factory in first-class shape from a Safety First standpoint.

b. A conference with the State Factory Inspector, at which he shall be invited to go over the factory with the Superintendent and members of the Industrial Engineering Department and suggest every possible change which can render working conditions more safe for the Company's employees.

c. That all reports rendered (in regard to conditions prevailing in the Company's factory) by the State Factory Inspector in the past, be collected and submitted to the Industrial Engineering Department.

d. That statistics in regard to past injuries to employees (as shown by reports to the Casualty Company) be compiled by months in such form that the nature of injury, length of disability, final disposition of the case, and cost to the Company, is shown—and that such records be kept up to date in the future.

e. That $20 be sent to the National Safety Council entitling the Company to active membership, to four sets of the weekly Safety Literature distributed by the Council, and to the use of such literature as a guide.

f. That steps be taken to awaken the interest of all the Company's employees in safeguarding their own safety, following the lines of organization set forth elsewhere.

h. That suggestions made by employees, executives, the State Factory Inspector, the Industrial Engineering Department, and the representative of the National Safety Council, be considered by a Safety Council composed of employees and executives of the Company, with a view to securing the maximum of safety in working conditions for every employee in the Company.

Safety First Campaigns.—The results of a "safety first" campaign must be brought to the attention of the company's chief executives constantly if that push from above is to be insured which is necessary to keep enthusiasm alive. A method of preparing the statistics is shown in the following recommendation:

STANDARD PRACTICE RECOMMENDATION.

ACCIDENT DATA.

The matter of injuries to employees is of importance in connection with the employment question. Certain companies and factories have a bad reputation in this respect, and careful men avoid them when possible. The best way to stifle such rumors is to produce figures to disprove them. If you are spending money on Safety First appliances, you should be in a position to judge the effect of such expenditure and to obtain the return which comes from being able to prove that employment in your factories is not dangerous.

Furthermore, accurate figures as to accidents and their causes are the best preventors of accidents and of the consequent inefficiency which comes from having crews disorganized by a member's absence or by the employment of semi-cripples through charity.

Statistics in regard to injuries are sometimes misleading, in that the more faithfully your factory executives report injuries the greater seems to be the number of accidents. As more and more minor accidents are reported, the worse conditions appear to be.

At the South Side factories 12 accidents were reported in 1908. Since that time your statistics show a steady increase almost every year, until you had 157 accidents reported last year—an increase of 1308 per cent. Inspection of your factories shows that the safety of your employees is guarded with unusual care. Under the circumstances, conclusions drawn from the figures would be erroneous.

For the reasons stated, and in order to encourage team work in the interest of safety among the men of each factory, together with a healthy rivalry between factories, we recommend that tabulations for each Factory, etc. (No. 1, No. 2, No. 3, Mechanical Dept., and Carpenter Dept.), be prepared, showing:

1. *Injured Employee's Name.*

2. *Date Injured.*

3. *Department in which injured* (according to list of Accounts).

4. *Nature of Injury.*

5. *Cause of Injury* (sufficient detail to determine whether accident was due to employee's carelessness, to the carelessness of a fellow-employee, or to something which the Safety committee should have attended to).

6. *Probable length of disability.* When the injured employee returns to work, or when it has been concluded that he will not return, the balance of the tabulation should be filled in as follows:

7. *Date returned to work.*

8. *Date quit* (provided he does not return).

9. *Reason for leaving Company's employ.*

10. *Length of Disability.*

11. *Settlement, if any.*

From this data it will be possible to classify all injuries according to their seriousness, and to locate the cause with a view to reducing accidents. We would recommend that this information be prepared covering injuries received last year, insofar as is possible, and that a new tabulation be started for the current year and be kept up to date.

Other Welfare Work.—Other branches of welfare work, such as health insurance, hospitals, profit-sharing and so on, are equally important. I have gone into detail in this one instance to show how the results should be brought to the executive's attention and how matters may be placed under his control.

In some quarters in this country the need for more general instruction in hygiene is almost unbelievable. I once knew a superintendent of construction, a man earning $150 a month, who had a bad case of rupture and treated it first with gin and then with antiflogistine! He finally had to neglect his work to such an extent that he was sent to a surgeon, and was cured by an operation. It is a common experience for company-welfare people to find that inefficient work is due to indulgence in patent medicines or to the worker's falling into the clutches of some charlatan doctor. The old picture that the soapbox orators used to paint of the hard-hearted employer phoning frantically for a veterinary when his horse is sick and almost in the same breath, phoning an employment agency to fill the place of the faithful worker just fired for sickness, is being cast into the discard as rapidly by the establishment of enlightened and in-

tensive labor conservation as by the displacement of old Dobbin by the motor truck.

As I have said, work of this sort which is worth doing, work which is practical and not a mere fad, is beneficial mutually to employer and to employee. It is as much the duty of the management to organize the work for which the money of the stockholders is being spent in such form that he may show them tangible results, as it is their duty to the employees and to humanity, to exercise the golden rule in business. Just as surely as honesty is the best policy, will dividends be earned and received by that Company which believes in the higher selfishness, and which casts its bread upon the water in the form of intelligent welfare work.

CHAPTER X

SELECTION AND CONSERVATION OF MATERIAL

Selection of Material.—The selection of the most effective material is a process both commercial and technical. The purchasing department usually takes care of the first element, and the research laboratory of the second. It is the duty of the executive to see that the business does not "fall between these two stools," as it were, as a result of the eagerness of the purchasing department to buy cheaply and the endeavors of the laboratory to produce quality.

In such work the administrator may be assisted by engineers called in from outside to organize for him an industrial engineering staff—from production managers to time-study corps; he may add an industrial engineer permanently to his personal staff; or he may try to do the work himself. The course adopted depends upon the type and size of the business, and upon what thoroughness and ultimate efficiency will satisfy the manager in question. If the material is not selected with a view to the possibility of fabrication when it is effectively processed by efficient labor, the final result will fall short of the standard that should be maintained.

In this work the engineering department is, in certain sorts of business, an important factor. Just how important a factor it is, depends upon the business and upon the scope and personnel of the department. I have known engineering departments that believed their full duty performed if they turned out a blueprint from which a pattern-maker could by a liberal exercise of the imagination figure out a pattern, or from which a machine shop could shape a casting. But I have known departments that were not content until their designs indicated fully the dimensions of the best and most economical casting which could be made, from the standpoint both of molding and of machining. In the first department were draftsmen, who blindly followed instructions. In the second were engineers—efficiency, industrial, or whatever you like—men who knew the process throughout, and who had made their observations in that analytical attitude of mind which underlies what is best known as scientific management. The set-up from castings made according to their designs would call for not one minute more than was necessary, and hardly an ounce of metal more than absolute safety required would be cut from its surface. The executive's ability to control the effectiveness of the engineering department in this respect depends, in the end, upon his ability to select and control his engineers.

Graphs Reveal Wastage.—Graphs showing the average percentage of metal removed per month in processing, as compared with the original weight of the castings, are invaluable. Castings are usually weighed upon receipt; if the weight of all the finished prod-

FIGS. 26 and 27. UNNECESSARY WASTAGE OF MATERIAL

If the bricks in the upper picture had been tested before they were built into the wall of an expensive oven, they would never have been used. The first firing destroyed them. In the lower picture, if the scrap had been segregated according to varieties instead of being mixed with dirt and shavings, it could easily have been sold.

uct is not determined, that of selected samples can be ascertained—which, if the process is an exact one, will represent with sufficient accuracy the finished weight. If further analysis is desirable, departmental graphs can be prepared. Throughout, it must be kept firmly in mind that scrap brings less per pound than castings cost, and that every ounce of metal removed unnecessarily means money wasted for labor. Graphs of this sort also show very quickly from which foundries it is the most economical to purchase, since the more perfect the casting the less extra metal will have to be allowed in order to insure the desired result.

The same sort of charts can be used, a little differently, to detect the wastage in skins or hides used in leather-working. The same principle is applicable in the tobacco business—in fact, in any work in which raw materials are purchased and fabricated. As in the case of the castings, fluctuation in the curves may lead the executive to investigate the purchasing department by indicating that unsuitable material is being bought, or it may lead him to examine the operating departments in a search for spoiled material.

In shoe-manufacturing concerns, where employees are paid to cut shoes rather than to save leather, in spite of the fact that the cost of the material represents from eighty to ninety per cent of the cost of the finished product, material wastes cannot be given too close attention by the executive.

In one of the cathedrals of England is the statue of a knight on horseback. The verger will call your at-

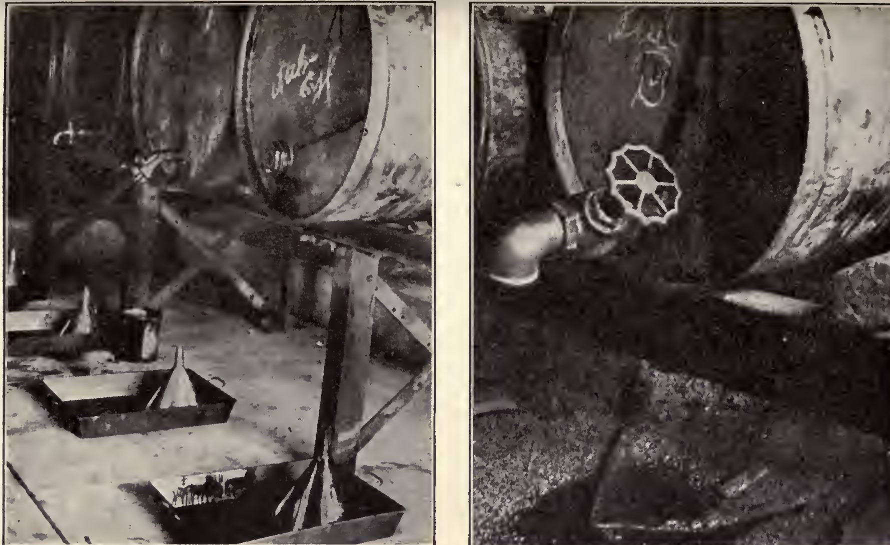


FIG. 28. WASTAGE AND CONSERVATION OF SUPPLIES

These two pictures are of the same oil house. In the picture at the left, the oil was allowed to drip into dirt and saw-dust, which was thrown away. Later the pans shown in the right-hand picture conserved the drippings.

tention to the fact that the tread of the left stirrup is missing. According to the legend, this statue was the life work of an ancient monk. As he was bringing his task to completion, he found that he had allowed insufficient marble for the left stirrup tread. Nothing could be done about it. His life work was ruined. The old man in his despair committed suicide. It is difficult to imagine a modern mechanic whose tool had slipped disastrously as the part upon which he was working was nearing completion, being so chagrined as to think of taking his own life! Why should he? If no one else notices whether he spoils one or ten pieces a week, why should he be interested? If he receives just as much pay if he spoils five per cent of his output as if he spoils one half of one per cent, and if he knows that should he be discovered a fairly good excuse or a contrite expression on his face will save him from anything more serious than a little bluster on the part of the foreman, why should he worry? Very probably the foreman himself isn't particularly concerned if he knows that the boss is not aware whether one per cent or five per cent of the material bought is being spoiled.

Analysis Essential to Economy.—In one plant, production losses amounting to over eighteen thousand dollars were reduced to eight thousand in less than a year through consistent attention on the part of those in control. In a glass factory, an analysis of conditions reduced the breakage in one department from forty per cent to ten per cent—once the necessity was made evident of having the work done by two men instead of by six boys. In an automobile-parts fac-

tory, statistics showing the cause of rejections resulted in action which reduced the amount of rejections thirteen per cent in three months.

An analysis of the cause of damage in manufacture in a large shoe factory located the trouble as follows:

PROCESS.	PERCENTAGE OF DAMAGE.
Cutting	1.6
Closing	22.3
Stitching	35.5
McKay Last	22.0
Welt Last	18.2
Balance Factory	0.4
Total	100.0

Further analysis brought out the fact that the following parts of shoes were damaged:

PART DAMAGED.	PERCENTAGE.
Vamp	59
Tip	20
Quarter	10
Tops	11
Total	100

Locating the trouble exactly, continuously, and relentlessly generally eliminates a large slice of it. In this particular instance, over six per cent of the sorts of damage described was eliminated in less than thirty days. It is by all means advisable to have a graph prepared which will show the manager each month the total loss and the loss by depart-

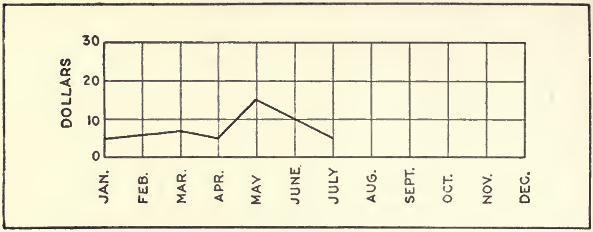


FIG. 29A. SPOILED SEMI-PROCESSED MATERIAL IN DEPARTMENT NO. 1

ments. It will tell him where to direct the spot-light.

Aside from the material wastes and losses due to carelessness, ignorance and inefficiency, there are very often losses traceable to dishonesty. In a certain large shipbuilding yard it was found that the men who cleaned up at night, working in collusion with certain machinists and others, were stealing thousands of dollars' worth of brass. The machinists threw pieces of brass into the waste receptacles during the day—and the cleaners threw them over the back fence at night. A Western railroad was driven into the hands of a receiver by systematic looting covering a period of years, during whch time millions were stolen by means of a system of charging up labor and material to car repairs. A graph in the hands of the president of the company, showing the actual shrinkage as compared with the pounds of scrap sold by the company—or in the hands of the directors of the railroad, showing the cost of labor and material per car repaired as compared with the standard cost would have prevented serious loss and disaster.

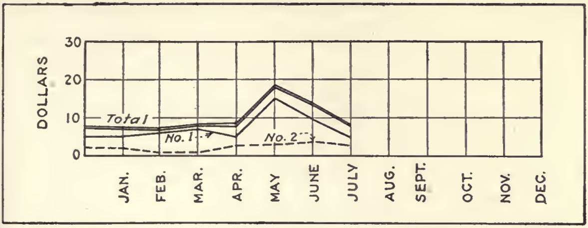


FIG. 29B. SUMMATION OF LOSSES IN TWO DEPARTMENTS

By assembling the graphs of rejected material to one which shows all departments, it is easy to pick out those departments in which the greatest losses occur. Further analysis of that department will show the cause of trouble.

Stopping Technical Wastes.—Certain sorts of supply and material wastes are what might be called traditional or technical. In one foundry the foreman insisted that a certain amount of flour be used in the molding sand. An investigator noticed that the man who prepared the mixture was sometimes careless and sometimes put in more flour than he did at other times. This seemed to cause no trouble, and it brought no complaint from the foreman. The investigator thereupon persuaded the mixer to reduce the percentage of flour for a day about ten per cent. The foreman made no objection. Ten per cent further reduction was made. Still no complaint. This was kept up until no flour was used at all—and the foreman never knew it!

Experimental work is about the only remedy for wastes of this sort. Statistics did disclose in one instance, however, a waste of solder in the manufac-

ture of gasoline tanks. Data kept in regard to the number of pounds of solder drawn by different workmen brought to light a wide discrepancy in the amounts used by different men on the same sort of work. A radical change was made in the method of soldering, and standard-practice instructions were issued which saved the firm a good many hundreds every year.

Storeroom Methods.—Storeroom methods are most important in connection with the control of the efficient selection and conservation of material and supplies. In this case the graphic method should by no means be confined to the preparation of general charts but should be applied in a very practical way in the storeroom itself. Where the continuous-inventory system is in use as described in the following Standard Practice Recommendation, it is comparatively easy to make such an arrangement.

STANDARD PRACTICE RECOMMENDATION

SUBJECT: STOREROOM INVENTORIES

Instead of making a count of all supplies in the storeroom twice a year, which requires the services of several members of the office force at a time when they cannot easily be spared, as well as of the General Storekeeper, interfering with the proper discharge of his regular duty during that time, we recommend the installation of the Continuous Inventory System.

Under this system the stock of each variety of supplies is counted when it is *low* and can be counted quickly. The result of the count is entered in red ink as shown on the Stores Card (Figure 30).

Arrangements should be made to count every article in stock at least once in six months. This can be taken care of by the storekeeper running through his cards occasionally and noting what is still uncounted.

FORM 340 2M

ARTICLE *Bags* SIZE *18" x 36"*

DESCRIPTION *Cotton - High Grade*

STOCK TO BE CARRIED *5000* ORDER IN LOTS OF *1000* DANGER LIMIT *4000*

PURCHASES						WITHDRAWALS			BALANCE	
DATE	ORD. NO.	QUANTITY IN	NET PRICE	PER	F.O.B.	DATE	BY WHOM	QUANTITY IN *Pcs*	DATE	QUANTITY IN *Pcs*
			#6995			3-26	H.R.	200	3-26	6978
						27	"	200		6778
						28	O.H.	300		6478
						29	H.R.	200		6278
						30	O.H.	25		6253
						4-1	H.R.	200	4-1	6053
						2	"	200		5853
						3	O.H.	200		5653
						4	"	200		5453
						5	H.R.	500		4953
						6	"	1000		3953
						6	O.H.	100	4-6	3853

FIG. 30. RECORD OF SUPPLIES

At least once a month the store room should be visited by some one acting in the capacity of auditor, who will select a number of cards from the file at random and by count verify the quantities shown thereon.

Every six months an auditor should go through all the cards and assure himself that a count inventory entry has been made in red ink within the six months period.

To illustrate the graphic method, suppose that sacks are stored in a pile against the wall. Let the storekeeper paint a red line on the wall at the exact height of a pile or of piles containing 4000 sacks. When this danger limit is reached, the red line comes into view and automatically calls the storekeeper's attention to the fact that it is time to order more sacks.

The same principle can be applied to nearly everything else. Bins containing bolts can be divided into

several sections, each of which will contain perhaps a thousand bolts. It is possible for the storekeeper to count the bolts exactly and quickly when he notices on his daily round that there are only three or four left in one compartment, and that another thousand will be broken into shortly. Moreover, if there happen to be only two red-lined compartments left he knows that it is time to order more bolts.

The application of the graphic principle in the maintenance at all times of a suitable supply of machine-repair parts is most important. Once the minimum number of each part which local conditions make it advisable to carry, has been determined for each machine or group of standardized machines, suitable racks or bins should be provided which shall allow all parts for such a group to be gathered together in one place. The racks or bins should be so arranged as to show at a glance whether or not the minimum which has been determined upon is being maintained. This makes it possible for the master mechanic or the superintendent to ascertain periodically whether or not the output is safe so far as repair parts are concerned.

Another advantage of this graphic system is that over-supply is automatically prevented. With a place for everything and everything in its place, there is no room for those overstocks which have a way of creeping into even the best run plants. Methods of arranging the stores so that enough, but not too much, of any commodity is on hand at all times might be described indefinitely. But an ingenious storekeeper, properly instructed, encouraged, and assisted by the

FIG. 31. EFFECTIVELY CONSERVED SUPPLIES—A PROPERLY ARRANGED STOREROOM

management will generally develop sufficient detail to insure an adequate supply, without tying up a lot of capital unnecessarily in dead stock and losing the interest that the company's money might have saved or earned elsewhere for its stockholders.

Material Charts.—It is just as well, however, even where the continuous graphic inventory is used, that the executive have a chart which will tell him at least once a month just how much capital is tied up in materials and supplies. This is important principally because the executive of a large business has access to all sorts of information that is not usually available to the storekeeper. The manager must be in touch with market tendencies, must know interest rates, and must inform himself in regard to a great many other matters in order to conduct the business intelligently and effectively. The manager who can foresee a rise in the price of material can save his company thousands of dollars by stocking up at a low price. Conversely, the manager who feels that the market will fall is throwing money away if he does not reduce his stock to the minimum.

To the manufacturer who is accustomed to purchase raw materials in large quantities—the miller, the shoe manufacturer, and the men who must combine with their regular business what often amounts to speculation—this is an old story. There are, however, thousands of manufacturers in the country who have forty, fifty, or even a hundred, thousand dollars tied up in miscellaneous supplies and yet never give a thought to the legitimate speculative side of the question, merely because the purchase and disposal of such

supplies are regarded as a subsidiary matter of little or no importance as compared with major problems of the business.

To such, a chart (Figure 32) showing the total value of supplies on hand together with certain details regarding the location and the variety of the stock, is likely to prove of considerable value. In one instance which came to my knowledge, a printing concern received notice that a sharp rise in the price of paper would take place on a certain date. The company had just finished putting their stores system on a scientific basis, had established the rate of use, determined the maximums and minimums, and so were in a position to buy heavily without danger of accumulating dead stock. Consequently they bought a year's supply of paper just before the rise, and saved themselves more than ten thousand dollars.

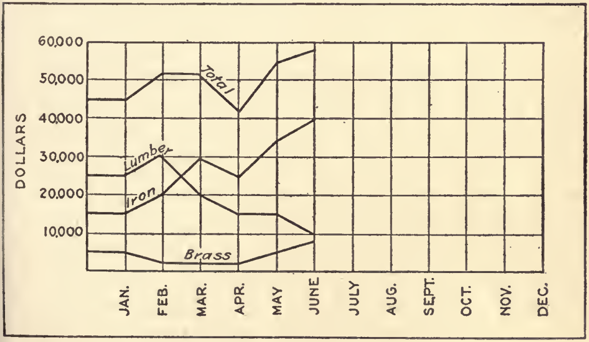


FIG. 32. SUPPLY CHART SHOWING THE EXECUTIVE THE VALUE OF MATERIAL ON HAND

Material and supply wastes—both of selection and of conservation—are so tied up with process wastes and with inefficiency in the use of labor that it is difficult to separate them. I have endeavored to illustrate certain phases of such wastes and to indicate methods of control for the executive. I shall take up other aspects of the situation in the chapters which follow. Meanwhile I wish to emphasize the fact that it is the duty of the executive to inform himself regularly and adequately concerning the efficiency with which materials and supplies are selected, stored, and conserved if he would secure to his stockholders the full return which is due them.

CHAPTER XI

THE EXECUTIVE AND THE OUTPUT

Output and Production Costs.—There is an old French song that has the often repeated refrain, "Amor, l'amour, toujours l'amour"—Love, Love, always love. The modern plant executive who will substitute "output" for "love" and then murmur the refrain from morning to night with all the fervency of the ancient bard, meantime devoting his energy continuously and consistently to realizing his dream, will reduce his cost of production. Output is the first thing to which the skilled industrial engineer turns his attention when he arrives on the job, and it is the last thing which engages his attention before he completes his work.

The successful executive realizes the importance of output, but he often loses sight of it, with a great many other obvious things, amid more novel details. It used to be said of Charles Schwab that his mere presence in a steel plant guaranteed a jump of ten per cent in the day's output. No greater tribute could be paid to the personality of a man. Meanwhile, since Schwabs are rare and factories are many, most corporations must resort to devices with which to supply the demand for super-personalities.

If we turn back to the table in Chapter VIII, page

127, which was used to illustrate the method of fixing the relative importance of various processes, and do a little figuring, we shall see at once the influence of output upon production costs. In the tabulation the cost per ton was found by dividing the dollars expended by the tons produced. The divisor was assumed to be 1200 tons. In other words, it cost $36 to move 1200 tons of clay from the cars to the drypans, or $0.30 per ton (see first item of tabulation).*

The divisor in question—1200 tons—was used to make division of the labor expense of grinding, of mixing, of making, of finishing and drying, of general labor, of repairs to buildings, machinery and tools, and of superintendence. The same divisor was used in determining the cost of supplies for repairs to buildings, machinery, and tools, and also in finding the cost of miscellaneous supplies, of the stable and of power.

In the departments mentioned the expense of processing the material in this particular business, and also in a good many other of the continuous-production type, would remain virtually the same, whether 1000 tons or 1500 tons were manufactured during the month. The cost added to a ton of clay when processed in such departments amounts to $0.90 for labor and $0.62 for supplies, or $1.52. Multiplying these amounts by 1200 tons, we find that the payroll for labor items was $1080, and the bills for supplies $744.00, so that the total cost to put the 1200 tons

* In the tabulation, and in these figures, I have avoided making allowance for process losses and have taken various other liberties with approved costing methods. This I have done advisedly, in order to avoid befogging the main issue with a lot of explanatory details.

through the departments here described was $1824.

If the output for the month had fallen to 1000 tons, the cost per ton would have risen $0.30 ($1824 divided by 1000 equals $1.82 per ton, or $0.30 more than the $1.52 above). If, on the other hand, 1500 tons had been turned out, the cost per ton would have fallen to $1.21 or $0.31 less per ton. The difference in this case, then, between the labor and material costs per ton in the selected departments with a quite possible minimum output, as against the labor and material costs per ton with an equally reasonable maximum output, amounts to $0.61 per ton. If, in addition, we assume an overhead cost of 50 per cent to cover administrative, sales, and miscellaneous fixed charges, the difference in the cost per ton will be increased further by $0.31. This brings the total difference in the cost per ton up to $0.92.

If we then assume a profit of 25 per cent of the total cost in the case of the average production (1200 tons), the sales price becomes fixed at $2.81 and the profit for the month becomes $672. When, however, we subtract the total cost of $2.73 in the case of the minimum output from this sales price of $2.81, we find that we have a profit of $0.08 per ton, or $80 for the month's work.

As against this, in the case of the 1500-ton maximum output, there is a profit of $1500, as we find by subtracting the total cost of $1.81 from the sales price of $2.81 and multiplying the profit per ton of $1.00 by the 1500-ton output. In other words, the plant manager who understands the value of output and who makes every move count to attain the ideal, earns

his company, in the case cited, $1500, or 1874 per cent more than the man who allows his attention to be side-tracked by a multitude of details—who can't see the forest for the trees—and who allows the output to drop. The accompanying table serves to contrast the production-cost figures under minimum and maximum output conditions respectively.

DIFFERENCE IN PRODUCTION COST AND IN PROFITS UNDER MINIMUM AND MAXIMUM OUTPUT IN SELECTED DEPARTMENTS

	Average 1200 Tons	Minimum 1000 Tons	Maximum 1500 Tons
Cost of Labor	$1080.00	$1080.00	$1080.00
Cost of Materials	744.00	744.00	744.00
Total Cost of Labor and Materials	$1824.00	$1824.00	$1824.00
Labor and Material Cost per Ton	$ 1.52	$ 1.82	$ 1.21
Overhead Expense	912.00	912.00	912.00
Overhead Cost per Ton	0.76	0.91	0.60
Total Cost per Ton	2.28	2.73	1.81
Assume Profit of 25% on Average; then Sales Price would be	2.81	2.81	2.81
Profit per Ton would be	0.56	0.08	1.00
Profit on Output Designated	672.00	80.00	1500.00

Mismanagement Reduces Output.—Output is not so dependent upon the supervision of some overseer of the Simon Legree type stalking about among the employees with a blacksnake whip as some of our socialistic friends would have us believe. The talk about "driving methods" and "speeding up" in connection with scientific industrial efficiency is—to in-

dulge in a colloquialism—"pure bunk." There has been, and there undoubtedly is today, a certain amount of Legreeism in existence in concerns where the old fashioned piece-rate system is still in vogue. The "wage slaves" have combated this system pretty thoroughly and effectively, however, by means of systematic idling, so that in actuality most of the oppression in such cases seems worse than it is—perhaps even is mere play-acting that the employees indulge in to convince their local Legree that his slaves are terribly overworked. In this day and age, labor conditions being what they are, the employer who is so short-sighted as to attempt to drive his men beyond the limit which local industrial public opinion has decreed is fair, generally is the loser finally.

Loss of output is not due to lack of Legreeism as much as to that mismanagement which makes it necessary for the worker to spend his energy and his time upon matters which do not contribute directly to output. As soon as you begin to analyze with the stop-watch the expenditure of the worker's time, you find that a considerable portion of his time is spent in waiting for something, or in fixing something, or in going after something. He is doing a thousand and one things that he shouldn't be expected to do, and while he is doing them the output of his machine is at a standstill.

Time-Studies Valuable.—Time-studies selected at random from a series of studies made during an investigation of conditions in a sheet-metal factory, disclose the following examples of this sort of thing in the cut and punch department:

1. Machine operators doing their own trucking—machine idle.

2. Machine operators handling their own scrap—machine idle.

3. Unnecessary handling by operators.

4. Congestion of material and semi-processed material—interfering with output.

5. Slow and inefficient trucking of raw materials—delaying output.

6. Lack of materials required to complete order—necessitating change of job and loss of output.

7. Use of wrong machine—work could have been done faster on some other machine.

8. Wrong adjustment of machine—resulting in loss of output.

9. Improper gauging—resulting in less pieces per machine per hour.

10. Insufficient methods of handling work—resulting in less output.

11. Improper placing of raw materials.

12. Improper placing of truck to receive machined material.

13. Improper placing of machines.

14. Breakdowns—machines, transmission and power.

Incidentally, of course, there was loss from the performance of unnecessary labor, in addition to that occasioned by loss of output.

Improper Plant Balance.—Even more serious, if possible, is the loss of output resulting from improper plant balance. In every factory, whether it is operated under the job-production system—as in the case of the usual machine shop—or under the continuous-production system—as in the case of flour and paper mills—there is always one department that fixes the

limit of the day's output. This is variously known by the name of "the squeeze" or "the neck of the bottle," or by some similar name denoting that at one point there is a constriction in the channel through which the factory's output flows. (See Figure 33.)

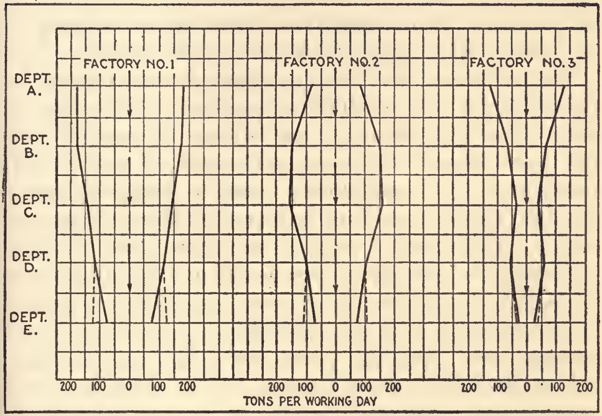


FIG. 33. LOCATION OF CONSTRICTION POINTS IN THREE FACTORIES MANUFACTURING THE SAME PRODUCT UNDER THE CONTINUOUS PRODUCTION SYSTEM

The chart represents the raw materials entering the "hoppers" at Dept. A, in each case, as shown by the arrows, and being further processed in Depts. B, C, D, and E. It will be seen that Dept. A, Factory No. 1, is capable of processing 360 tons (180 tons on each side of the zero line), that when this reaches Dept. B, the constriction has reduced the flow to 340 tons, and that by the time the output has reached Dept. E, it has been constricted to 160 tons. This constriction point determined the output of the factory regardless of the capacities of the earlier departments. The same thing applies to the two other factories—in No. 2 the constriction is at both ends, and in No. 3 at the center. The dotted lines show the engineer's first points of attack.

It may be that there are not enough machines in the cut and punch department; it may be that the enameling department lacks ovens; possibly there are not enough planers to keep the mill supplied; the hot tables may be inadequate in the kitchen of the great hotel. Whatever the industrial activity, there is a congestion point somewhere that limits the output of those articles upon which the income depends.

The reduction of this congestion to a minimum is the work of the production engineer. Although it may seem, superficially, that all that is needed is a few more shears, ovens, or hot tables, in reality the problem is most complicated, and a competent production engineer earns all he is paid, however large his salary. Balancing a factory and then keeping it in balance is as difficult as the problem that confronted the cats in the fable—they gave their pieces of cheese to the monkey who was to make a just division by nibbling first from one piece and then from another, but finally their cheese disappeared. Unless exact methods are employed, as fast as one department is balanced another is thrown out of balance.

For instance, in a certain shoe factory the change from a plain to a perforated vamp—a change likely to be called for any day—required an increase of 35 per cent in the force in the vamping department to preserve the balance with the other operations. Only the most careful sort of planning and dispatching, in addition to a proper physical balancing of machines, equipment, floor space, and so on, could prevent a general upset of this sort. That the right result can be secured, however, is proved by the fact that

another shoe factory so planned and carried out their work that they kept their employees busy 99 per cent of the time, and the volume of work at any point in the process varied only 1 per cent at any one time.

The first case cited is a typical example of conditions that exist in every industry—conditions which, if the industry is large and the process complicated, can be remedied by the work of the expert who builds in the executive machinery of scientific production—centralized control, planning, dispatching and all that goes with them. Efficiency can be secured only if the skilled production engineer and those executives who comprise the management give their constant attention to the problems at hand.

Daily and Monthly Output Charts.—The best method of getting the whole organization behind the output and keeping them there, organized for the big push, is to keep the daily fluctuation before the man who controls the company's policy, be he general manager, president, or chairman of the board. Such a man knows the value of output—otherwise he would not have risen to the position of supreme control. Unfortunately he is generally a busy man who has many calls upon his time, and his inquiries are consequently likely to be spasmodic and irregular. He should, therefore, arrange, as I have stated elsewhere, to have what he should know forced upon his attention—rather than take what chance brings to him.

In this case a chart showing in condensed form the output, for the day previous, of all the company's factories should be placed under glass upon the executive's worktable every morning at 10 o'clock,

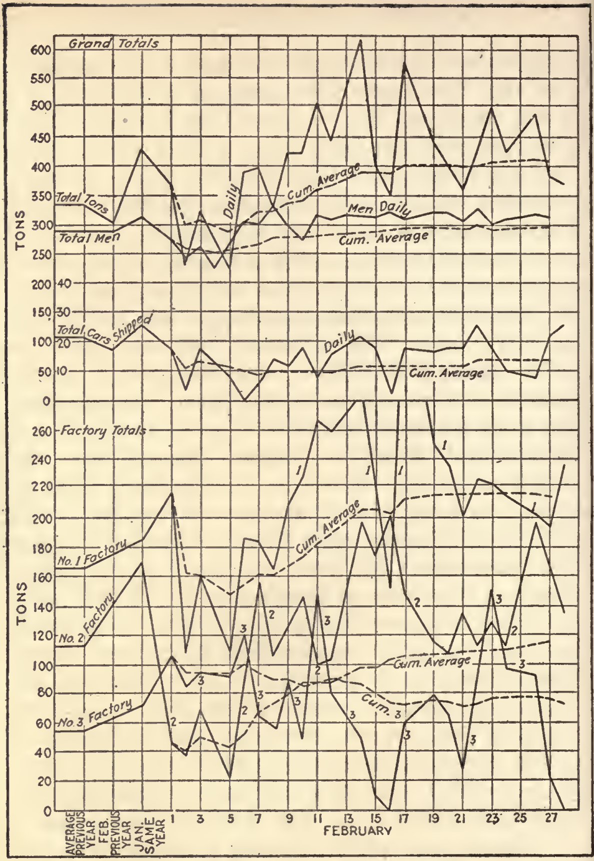


FIG. 34. DAILY OUTPUT CHART

Summation of factory monthly totals and cumulative averages of the lower curves is shown in the top curves. Other curves show labor and shipments. Previous averages are easily compared.

by his secretary. It will show him exactly what is being accomplished, and in such a manner as not to encroach unduly upon his time but at the same time quickly enough after the actual performance to allow a full investigation when necessary.

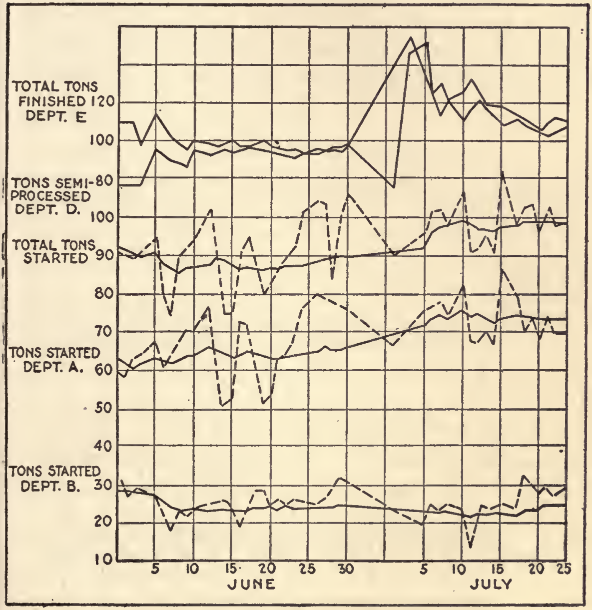


FIG. 35. DAILY TOTAL AND DEPARTMENTAL OUTPUT

Department C has been omitted to avoid confusion of lines. Owing to the nature of the process, the totals in Departments D and E are the summations of totals in Departments A, B, and C, of about 30 days previous. Only two of the five months referred to in the text are shown here. Fig. 40, page 000, covers the full period.

The design of such a chart depends upon the sort of business which it is to portray. Almost without exception it is advisable, however, first to show the total output and then to subdivide into factories and into departments so that the executive may, in an instant, analyze fluctuations in the first case by reference to the lower curves. This enables him to take up the causes with the particular department responsible, and conserves his time and that of his depart-

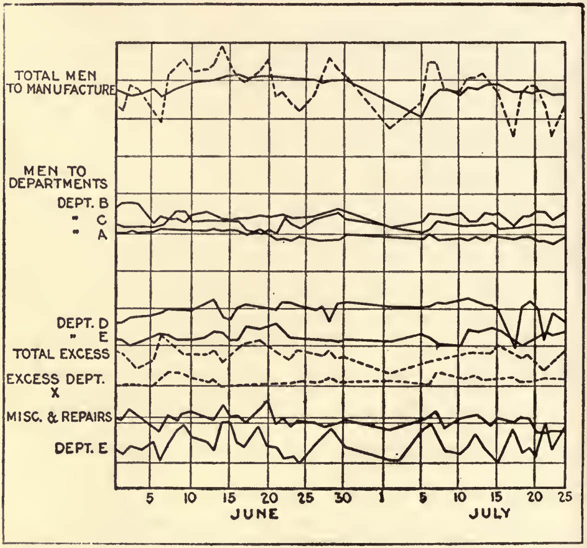


FIG. 35-A. DAILY TOTAL AND DEPARTMENTAL EMPLOYEES AT WORK

This graph is supplementary to the graph shown in Fig. 35.

ment heads. Figure 34 shows a chart of this kind.

I have also shown a monthly-output chart, Figure 35, by means of which the chief executive of a large corporation kept himself in touch with the effect of some industrial engineering work that was being done in one of his factories. It will be noted that the output in thousands rose steadily in the three controlling departments during the five months, that the working force decreased steadily, and that the number of units turned out by each man every working day increased enormously in consequence.

I have endeavored to show in this chapter the importance of output to the executive and to the stockholder—its effect upon the cost of production and upon the profits. I have tried to show that output is not a matter of driving the employee, but of assisting him to do his work more effectively and with less effort. Furthermore, I have shown the necessity of plant balance and of having the machinery for maintaining this balance. Finally, I have led up to the conclusion that output is one of the chief concerns of the management, and have endeavored to indicate one method of keeping the facts before the chief executive. I shall describe in later chapters methods of increasing the results shown by the last charts described by means of more detailed statistical executive control.

CHAPTER XII

THE EFFICIENCY OF SUPPLY OF LABOR

Problem of Idle Labor.—If you will stroll through a factory and count the number of busy employees—those who are actually engaged in productive work—in each department, and will divide their number by the total number of employees, you will gain a rough idea of the efficiency of supply of labor at that particular time. If you will make such a trip every hour for a week or two, and will make due allowance for the men who got busy when they saw you coming, you will gain a very fair idea of the proportion of men employed in each department as compared with the number actually required to do properly planned and dispatched work under the standards which then exist in that department.

Of some 45,000 men so observed during numerous trips through one factory, 38,000 were noted as engaged in productive work. On this basis, the "efficiency of supply of labor" was 84 per cent. According to the number of men carried on the payroll, it should have been possible, during the trips made, to observe 52,000 men actively engaged. On this basis the "efficiency of supply of labor paid for" by the company was 72 per cent. Just what had become of the 7,000 missing men was a mystery never completely

solved. The washrooms could hardly contain 15 per cent of the force—although in a good many factories the washrooms, the "hole and corner" impromptu "smokers," and the continuous desultory migration of employees from one department to another, will easily account for an average disappearance of ten or twelve per cent of the paid employees at all times.

Any one who will make a few such trips through the average factory will be amazed at the amount of "fading" going on. As he enters a department, a group of men have apparently always just finished something important and are just departing upon equally important business elsewhere. Other groups are always just breaking up in other departments, and the men are "fading out" in different directions. If the investigator will follow one of these men, he will quite likely cause him acute embarrassment while the poor fellow is improvising something which looks like productive work.

"The Man Higher Up" Responsible.—The man is not to blame. If the foreman, the superintendent, and the manager didn't know any better than to hire more men than they needed, why should he hesitate to accept a livelihood, even if he does have to play the hyprocrite at times? Let the usual superintendent pass a congestion point when the workmen are sweating blood and the work is piled to the ceiling, when the preceding department is marking time, and the succeeding department is yelling for work—and he will be a strong man indeed if he refrains from turning in a hurry call to the employment department for more men. When things have straightened them-

selves out again the new employees become habitual "faders."

Not long ago I heard an old railroad man telling a companion about a strike on a certain road in Arkansas—"And the biggest darn fool thing about the whole business," he said, "was that when the boys walked out the manager found out how few men the road could get along with, and only about two-thirds of the poor critters ever got their jobs back!"

All this goes to show that the statement of a famous efficiency engineer, that "The industries of America are for the most part under-supervised, over-equipped, and over-manned," is strictly in accordance with the facts. The remedy—from the standpoint both of labor and of capital—lies in the application of all those exact industrial methods which have been developed under scientific management. Labor does not enjoy "fading"—else why does it slink away? Men who haven't enough to do to occupy their thoughts are bored to death. Prices raised on account of the high cost of manufacture—due to wastes of labor and to wastes of material—simply raise the cost of living, and the workman loses, because wage raises always lag behind price raises. The elimination of excess labor does not mean firing men right and left. It means neglecting to fill the places of those who leave voluntarily, and dividing the saving so effected among the workmen who remain—the cost of carrying out improvements which benefit capital and labor alike and the stockholders of the company.

Co-operation and Collective Action.—Testifying before the Federal Commission on Industrial Relations

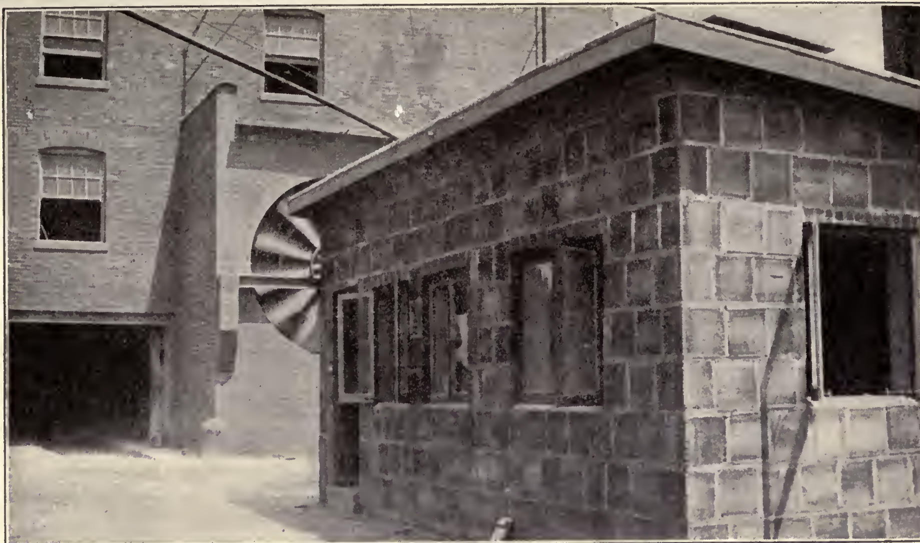


FIG. 36. THE DISPATCH OFFICE
This should be located as close to the factory's center of population as possible.

at the New York City Hall, Ida M. Tarbell made the following statement, which appeared in the New York Times:

> There seems to be a silent revolution going on in American Industry. . . . There is an increasing desire to give the employee full justice, and the idea is steadily at work.
>
> It is coming out fundamentally in what is called the Science of Management. This breaks away entirely from the old ideas. It means better earnings, shorter hours and, most important of all, the development of the man as a worker.
>
> One reason why Scientific Management is so important is that it requires co-operation and collective action to make it really successful.

Miss Tarbell criticized union leaders for not going into the shops and studying scientific management instead of opposing it. One third of the extra product, she held, should go to the managers, one third to labor, and one third to the shop.*

Just as in the case of output, the work of proportioning the number of workers to the actual work to be performed is the first and last thing to receive attention from the industrial engineer. We saw in the last chapter how the number of men at work in each department was charted on the same sheets as the output. There are even more graphic methods of bringing existing conditions to the attention of the executive.

"Excess Board."—During the installation of the dispatch system in one department of a large Eastern steel company, I noticed the repetition of several cards marked "helping on floor." During one of the

* See Vol. 10, Industrial Cost Finding, in the Factory Management Course.—the Ficker method of wage payment.

dull periods these cards were sorted out, and were found to represent 17 per cent of the total labor in the department. They really represented the number of men for whom it was "necessary to find something to do," something upon which to throw away the company's money, to be exact—largely because the work was neither properly planned nor properly dispatched. In order to bring this fact more forcibly to the attention of the foreman, these cards were arranged by themselves at the right-hand side of the dispatch board.

The effect of this arrangement was so immediate and so forcible that it gave rise to a device which has since become known as the "excess board." This is illustrated in Figures 37 and 38.

The excess board—at the right in each case—is painted red. The first picture shows thirty-two "service cards" on the board. The second picture, taken a couple of months later, shows fifteen cards, and the last picture, Figure 38, taken several months later, shows seven cards. What was accomplished in the way of the non-replacement of unnecessary labor in the five months, by this means and by certain other changes in manufacturing methods, is shown by the chart in Figure 39.

It should be noted that the curves on this chart show that the output rose steadily, that the actual number of men employed decreased, and that the number of units turned out daily by each man increased enormously—in this case considerably over 25 per cent. One of the greatest factors in the accomplishment of this result was the practice of calling the

FIG. 37. THE EXCESS BOARD AS FIRST INSTALLED AND TWO MONTHS LATER
Note the reduction in the number of service cards—a decrease from 32 to 7.

FIG. 38. THE EXCESS BOARD AFTER FOUR MONTHS—ONLY SEVEN MEN LEFT

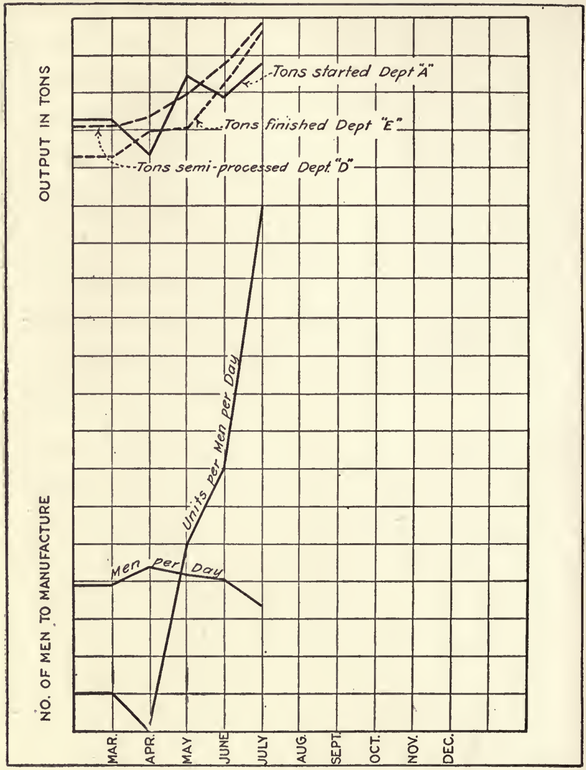


FIG. 39. MONTHLY PRODUCTION GRAPH

What the excess board and other things did for one factory.

attention of the foreman and the superintendent—regularly and relentlessly at ten o'clock every morning—to the fact that the plant was using thirty or thirty-five men more than they themselves had previously stated were necessary for the operation of the factory.

The small white card about half way up the board in Figure 37, gave a brief synopsis of just how the excess labor was occupied. Every morning a glance at this card sent the superintendent upon a tour of investigation. Men who quit in certain departments were not replaced, and the results were those shown.

Operating the Dispatch Board.—Under glass upon the chief dispatcher's desk, as shown in Figure 40, were placed such charts as those shown in the last chapter, together with various other graphs which will be described later. The object of all this apparatus was to apply the rachet principle to the gainful activities in the factory. Whenever a particularly high output was attained, the charts recorded the fact, as well as the number of men required, and this fact was called to the attention of those in charge to show the advantage of certain changes made in the method of doing the work. Whenever the output fell off, or the force increased, the plant executives and the industrial engineering department held a conference to determine the cause. In other words the excess board, plus the charts, automatically kept those responsible keyed up to make a thorough examination of every improvement, in order to make it permanent, and to make a searching investigation of every retrogression, in order to prevent its recurrence.

FIG. 40. THE CHIEF DISPATCHER'S DESK
The department schedules can be seen on the wall and the control charts are shown on the desk under glass.

This graphic feature of the dispatch board is one of its most valuable points, and yet it is one that is sometimes little understood even by very competent engineers. Take, for example, a manufacturing plant employing four hundred men in say three factory units, in each of which work similar in principle is being performed in a number of successive departments. The superintendent of such a plant cannot see every man in every department several times a day, or often enough to keep really informed as to what is going on. I have shown the impossibility of this procedure at the beginning of the present chapter in the account of the trained observer's experience—in which he found that 12 per cent of the payroll was invisible at all times. Even if the superintendent attempted to learn by actual observation at just what each man was working at a given time, and just how well he was doing, a trip through such a plant as I have described would require from two to three hours a day, as every timekeeper knows who has used the old-fashioned check-up type of time-book. Three such trips would leave a conscientious superintendent very little time for anything else.

The superintendent can, however, enter a centrally located dispatch office in such a plant, and in fifteen minutes can see his whole working force and their activities in camera obscura, as it were. On the walls are located three dispatch boards, each one representing a factory. (Figure 40-a.) On each board the service cards are arranged by departments, marked by labels. Each service card represents a man engaged in some sort of work, and all men in

FIG. 40-A. DETAIL OF DISPATCH BOARDS—NOTE GRAPHIC DEPARTMENTAL FEATURES

excess of the number authorized are arranged on the excess board.

A glance at the boards and at the account numbers on the service cards shows the superintendent or the industrial engineer which factory is busiest—as regards the number of men at work—and informs him just what each man is doing. Labor employed in Department A in Factory No. 1 can be compared with the labor employed in Department A in Factories No. 2 and No. 3. Such comparisons give birth to ideas that are valuable. Why are more men needed in Department A in Factory No. 1 than at Factory No. 2? The answer may lead to a departmental reorganization that will be worth thousands a year to the company.

Omniscience of Superintendents.—There is a certain type of owner and manager who judges his superintendents by their ability to answer offhand any question asked at any time. I once worked for a man who expected me to know the exact status of every machine and of every piece of equipment in the factory, and to be able to say just how many men were employed in each department the moment he reached the office in the morning. He felt that I, as superintendent, ought to be able to reel off a bunch of statistics that would place the whole situation before him at once. Theoretically the superintendent, being the one responsible, should be able to answer any question and should have the privilege of stating the situation to his immediate superior. Practically, a superintendent who is held to such a theory develops, in nine cases out of ten, into a plausible liar.

To any one who has been a superintendent in a factory employing four or five hundred men organized according to the usual methods, the reason for this is obvious. The moment the superintendent arrives on the job—say at 7 a. m.—he is met by Billy Jones, a foreman, who tells him that half his crew had a "big Sunday" the day before and that he can't run until six more men are available. The superintendent tries Lysander and Ephriam, other foremen, and finally scrapes up six men. Meantime a machine has broken down, and Terence McGuire, the foreman of its crew, after hunting the superintendent frantically for half an hour, finds him and tells him that the master mechanic, Angus McTeague, "the dirthy spalpeen," won't leave the repair job he is on long enough to assist him in his trouble.

Our superintendent, after straightening out this Scotch-Irish tangle, gets ready to draw a long breath, only to be told that the crew in Room 24 has finished the work they were on, and "what will they do next?" While these major operations have been taking place, he has settled a number of petty disputes, has given innumerable words of advice to foremen as to methods and means of accomplishment, has fired a man or two and hired one or two, has been called to the phone a couple of times, and has passed the time of day with several of his cronies. It is now 9 o'clock and, inasmuch as all of these things have urgently demanded his time, he knows about as much about what the rest of the plant is doing as if he had been spending a week-end in Timbuctoo.

When the cry of "General Manager on the phone"

finally reaches him, he hastens into his office with a fervent, if silent, appeal to his household gods to help him to improvise a report to the owner with the fluency of a Münchausen and with the non-committal convincingness of a Delphic Oracle. He can't answer the questions. He doesn't dare say he doesn't know. So he lies, and prays that he may get away with it.

The Proper Method.—The thing is all wrong from start to finish. In the first place, the superintendent should not be expected to act as a census-taker—of either men or machinery. Such information should come from the dispatch office at a certain hour—some time before ten o'clock—every morning, and entered upon a chart upon the desk of the general manager.

In the second place, Bill Jones should have applied at the dispatch office at about 7.05 a. m. for his extra men, and either should have been given an order on one of the "reservoir" crews for his men, or else should have had men hired for him from the applicants for work waiting at the dispatch office or at the employment office. This system would have saved the superintendent's making his begging trip to Lysander and Ephriam in search of men.

Thirdly, our friend Terence, instead of indulging in a race riot with Angus for half an hour, and then appealing to the superintendent—the machine meantime being out of commission with several men standing idle—would have phoned the dispatch office for an "expense order," and Angus would have been on the job under the recorded and impersonal orders of a third party not interested in the Scotch-Irish question.

Fourthly, the crew in Room 24 would have had its morning work planned for it twenty-four hours in advance, the day before, so that frantic efforts on the part of the superintendent to find something on the spur of the moment—any old thing, regardless of the need, the preparation, or the value of the work—would have been avoided.

The words of advice as to methods and means of accomplishment, the courtesies and the judicial decisions of his position we will leave him, together with the phone calls if they are of such importance as to merit the attention of a man whose time is as valuable as is that of the superintendent who is competent to rule a kingdom of five hundred.

In the hour and a half which we have saved him he might have planned the improvement of a process, he might have devised means of increasing the output or of decreasing the cost of production, or he might have done innumerable things for which his brains—the highest priced, and therefore supposedly the most valuable in the plant—were the best fitted.

This may seem an exaggerated case, but it is not very much different from what is happening all over the country under "casual management." In one instance, the general superintendent of a factory employing over 1200 men and women was time-studied by an expert for over 40 hours. Work that occupied over 30 per cent of his time could have been performed by 50-dollars-a-month clerks, and his brains could have been used for something worth while.

Function of Dispatch Office.—Every time a $6,000-a-year superintendent spends 3 hours a day doing

things which a $600-a-year clerk could do just as well, he robs his company of $6 in wages and of at least $60 which his brains should have been able to save in devising better methods, if he had scheduled them to a $20-a-day grade of work.

The increased return to the company from such a course can hardly be conceived until the thing has actually been tried. Methods similar to those described allowed one superintendent sufficient time to exercise a latent inventive genius which revolutionized a considerable branch of manufacture. The output of one machine which had never in the history of the business exceeded 5000 units per day, was increased to 13,000 with but little increase in the operating crew. In another factory, by means of improved methods, all sorts of articles were manufactured which had been considered impossible, and great improvements in quality were made. In one case, the release of a superintendent from routine detail resulted in the acquisition of several valuable patents. In each instance the best brains were released from routine, and the results were of incalculable value to the company in question.

The dispatch office is the pulse by means of which the factory management interprets the status of labor in the factory—its quantity and its use—just as the storeroom is the pulse by means of which it interprets the status of material. The interpretation is just as immediate as is that which is made by the skilled practitioner with his hand on the patient's wrist. The executive who is so equipped, who is skilled in interpretation, and who is able in action,

need not fear that conditions will arise of which he will be ignorant, that cancerous growths will fasten themselves upon the business to its destruction—he is not dependent upon warnings six weeks old, upon costs which are ancient history. He knows today what is happening today. He may not always win every battle, but at least he cannot be taken unawares. And the man who has had an opportunity to use every resource at his command, even if he loses, goes down fighting gloriously, in the knowledge that he has had a fair field and an opportunity to do his best.

CHAPTER XIII

EFFICIENCY OF USE OF LABOR

Law of Dependent Sequence.—Once the executive has determined that he is using as few men as it is possible to use, with due regard, of course, for their health and ultimate prosperity, he is naturally interested in how effectively the men who are present are performing their tasks. It is quite possible, for instance, to determine by analytical study that a certain machine can be operated most effectively by three men, instead of by five. When the crew has been reduced to three men, the "efficiency of supply" of labor then may be said to be 100 per cent. If these three men who are selected to man the machine spend their time shooting craps, the "efficiency of supply" of labor is still 100 per cent, but the "efficiency of use" of labor is zero. It is just as important that your men employ their time effectively as it is that your plant should not be over manned. The importance of using as few men as possible, and of using those men effectively, can perhaps best be shown by citing an example of the oft-quoted "law of dependent sequence":

If four men make four boxes an hour, meantime getting in each other's way to such an extent that only two of the men are working effectively at any

one time, two men are not needed, and the "efficiency of supply"—that is the number of men required to do the work as compared with the number being paid to do it—is 50 per cent. Thus:

$$\frac{\text{Standard (2 men)}}{\text{Actual}\quad\text{(4 men)}} = 50\% \text{ Efficiency of Supply of Labor.}$$

If two of the men are given other work, and if, while the two remaining men are making four boxes in an hour, their work is analyzed and it is found that they can turn out twice as many boxes if they are given properly cut wood, suitable tools, material when required, a well-lighted working place, some careful instruction, and an incentive in the form of a bonus for attaining the predetermined standard—then their former effectiveness, as compared with their new accomplishment, is again 50 per cent. Thus:

$$\frac{\text{Standard— .5 hour}}{\text{Actual— 1. hour}} = 50\% \text{ Efficiency of Use of Labor.}$$

The accomplishment, then, measured in boxes made per hour—of each man who now turns out four boxes in an hour is four times as great as it was when he was turning out one box per hour, or,

Efficiency of Supply of Labor (50%) $\times$ Efficiency of Use of Labor (50%) = Final (vs. Original) Efficiency (25%).

Setting the Standards.—It is this efficiency of use of labor which I wish to consider in this chapter in connection with the ways and means of bringing it under the control of the divisional and general factory superintendents, and so under the control of the management.

The work of setting the standards is a long and intricate task which must be done by a trained analyst—a man who cannot possess too much technical knowledge and skill in the application of the scientific method. His work with the stop-watch, which is described elsewhere,* is another story, which I shall not attempt to tell.

The Old "Gad and Carrot" Principle.—The method of placing the executive in touch with, and so assisting him to maintain, the effectiveness with which the labor is performed by the men employed throughout the plant, depends somewhat upon the type of the business in question. Under the continuous-production system a principle is involved which the old-time superintendent called "using the machine to shove the work onto the men." The system is perhaps as well illustrated as possible by the case of a brick machine turning out a certain number of brick an hour, which a crew of men are required to stack on cars as they are made. The machine would be speeded up to make just a few more brick than the men, by working desperately, could handle—to "shove the work onto them" in other words. The eventual answer that the men usually make under such circumstances is—figuratively, or perhaps in some cases actually—to throw a monkey wrench into the machinery.

The old-time superintendent, realizing the unsatisfactoriness of—as he would express it—"trying to drive the mule with the gad alone," would sometimes

* See "Planning and Time Studies," Vol. 3, Factory Management Course.

"tie a carrot in front of his nose," in the form of a box of cigars to be given to the crew for a good weekly output. Or, in some cases which have come to my attention, he would "give 'em a keg of beer if they busted the record." Such gropings as this bring home to the investigator the real need for scientific management. The old-time superintendent is a product of his environment, and the avidity with which the better sort of minor executives seize upon certain parts of the newer and more exact methods—recognizing at once their value—is one of the things which keeps up the courage of the industrial engineer during the long and uphill path which must be pursued in introducinig innovations into any manufacturing plant.

The Corresponding Modern Principle.—What such a superintendent is trying to express with his reference to gads and carrots is this—that human nature needs encouragement as well as driving; that fear, as a motive, must be supplemented with hope; that the prod must be assisted by the helping hand; that there must not only be plenty of work for each man to do, coming to him promptly, but there must be an opportunity for him to push away from him all the product that he can make—that it is as necessary for the subsequent department to exert a pull as for the preceding department to exert a push; and that once the supply from the rear and the demand from the front is adequate, there must be something to add interest to the game in the form of a score, if the worker is to do his best with ultimate satisfaction to himself and to his company.

Gang Must Fit Environment.—What is meant can best be shown by the accompanying photographs, Figures 41, 42, and 43, which illustrate certain violations of the principles of gang grouping. We have all heard the story of the Irish contractor who, in a moment of abstraction at his mother's funeral, called out to the pall-bearers, "There's too many of yez on thot job, two of yez come over here." The upper photograph in Figure 41 shows two men standing by their wheelbarrows, waiting, while a third man, ahead of them, dumps his barrow and returns along a narrow path. At the moment, then, two men out of the three have no work to do. They couldn't work if they wanted to. Neither carrots and beer nor bonus could drive them to work. The gang does not fit the environment. Bill and Pete can't work until Hank has returned—as is shown in the lower photograph.

If the boss had wanted Bill, Pete, and Hank to have an opportunity to work all the time, he should have arranged a circular course. If he had done so, each could have followed that course and dumped in turn. There was, in this case, plenty of room at the pile for all three to load their barrows at once, and plenty of supply, but only one could dump at a time. In other words, there was not enough demand. The efficiency of use of labor in the first picture is 33 1/3 per cent.

Reservoirs of Work.—The upper picture in Figure 42 illustrates the necessity for these reservoirs of work—"push reservoirs" and "pull reservoirs." For a great many years manufacturers of sewer pipe in those sections of the country that possessed clay strong enough to stand handling by the skid method,

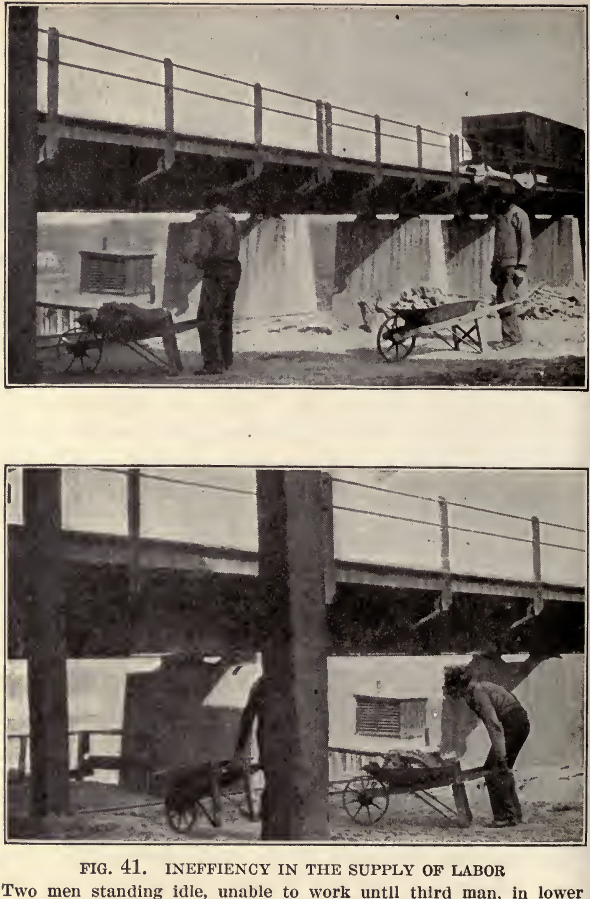


FIG. 41. INEFFIENCY IN THE SUPPLY OF LABOR
Two men standing idle, unable to work until third man, in lower illustration, has emptied his load. (See page 247.)

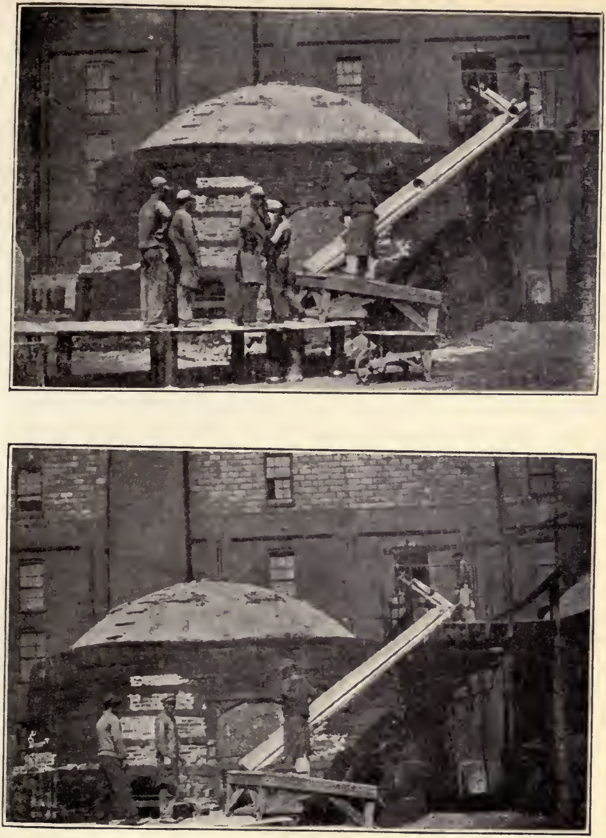


FIG. 42. INEFFICIENCY IN THE SUPPLY OF LABOR
The same conditions as shown in the previous illustrations prevail here—men standing idle, waiting for their work. (See text.)

were the envy of all beholders—especially when the beholder was a competitor from some section of the country where clays were fragile. On the face of it, it would seem that dependence upon gravity would be about the cheapest means of transportation which could be found.

This photograph shows pipe being handled by the skid method. It will be seen that the newly dried pipe are put into the chute which leads from the third floor, through a door on the second floor of the building in which they have been dried, and carried to the kilns in which they are to be baked and glazed. The man on the upper platform eases the pipe around the turn, the man on the lower platform receives the pipe and hands them to the man on the runway; one of these men is seen carrying two pipe to the kiln, and three of them are seen waiting for their loads. There are six men in the picture, and the only ones who are performing productive work are the man on the second-story platform and the man who is carrying the pipe away. The efficiency of use of labor is therefore 33 1/3 per cent, in spite of the fact that these men are on piece work!

The lower picture shows all the men idle, waiting for some one, who is invisible, to slide some pipe down the chute. The efficiency of use of visible labor would, in this case, have to be placed at zero. In the upper picture we have four men who can't work, because no work is supplied them. The reservoir is empty—they have nothing to draw from. The same thing is true in the case of the men shown in the lower picture—plenty of demand by the men who are

stacking the pipe in the kiln, but no supply from the third floor.

As a matter of fact, in this particular case the men who transported the pipe from the chutes to the kiln were waiting about as much in the kiln as they were at the chute; the reservoirs which they were filling were quite as apt to be found full, as the reservoirs from which they were drawing were to be found empty. The solution was found by reorganizing the crews, by providing gravity elevators and two wheel trucks, and by placing the men on bonus, once conditions had been standardized.

Results of Standardization.—Figure 43 shows conditions as typical after standardization of the work as those shown in the previous photographs were of conditions that prevailed before standardization took place. Under the new conditions, the trucks became traveling reservoirs of potential work. A trucker ran his empty truck onto one elevator platform, whereupon, as it ascended, another truck, filled with pipe, descended immediately. The wait at the elevator constituted merely proper fatigue allowance for the trucker. As soon as the filled truck descended, the trucker wheeled it into the kiln and found another empty truck awaiting him. Meantime the men stacking the pipe always had plenty of pipe to stack, since there were various partly emptied trucks to draw from. The amount of their work was therefore limited only by their strength and quickness. Incidentally, the men on the drying floor always had empty, or partially empty, trucks to load and unlimited pipe on the floor to draw from, so that

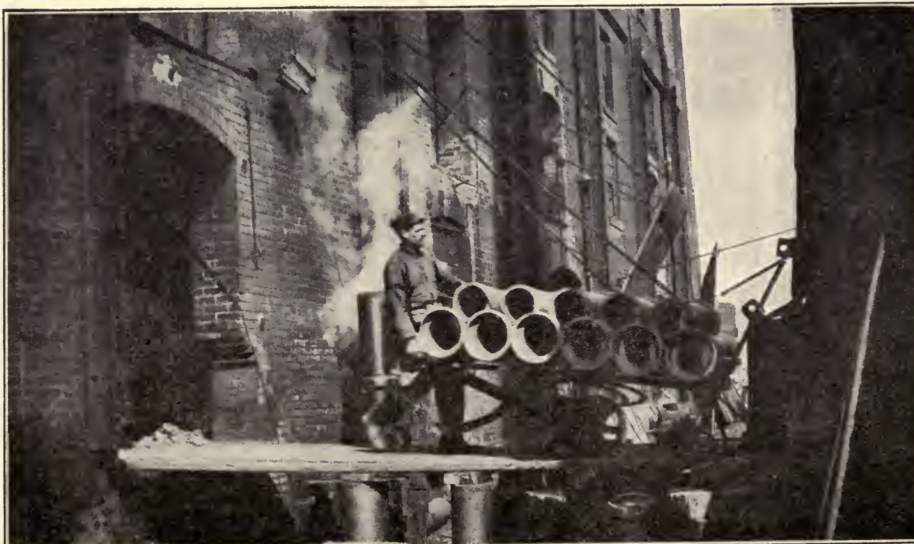


FIG. 43. EFFICIENCY IN THE SUPPLY OF LABOR
One man with proper equipment replaces all of the men in Figures 41 and 42.

the work of these men was to be measured by their strength and ability. In other words, every man on the crew—truck-loaders, wheelers and stackers—was provided with ample supply and demand reservoirs; their personal output was consequently limited only by their own personal ability.

Lack of Standardization Prevalent.—These particular examples are cited to represent typical conditions in industry, because the cases referred to occurred out of doors and were easily photographed, and because they are simple enough to be easily explained. The same principles underlie almost every industrial activity. In a certain steel concern five men were assembling switches which required that some twenty holes through two wing rails and the filler be lined up, bolts inserted, and nuts placed and tightened. Upon superficial examination, it appeared that all five men were busy. Analytical time-study, however, disclosed the fact that each man was seriously held back because the reservoirs of work ahead of him were full about half the time—each bolt-inserter was held up by the tightener ahead of him. After standardization the same work was done by half the five, the odd man being utilized by dividing the time of one man between two crews.

The same thing is happening in shoe factories and in glove factories, where the leather passes from hand to hand and each worker performs a certain operation upon it. If each operative does not have a reservoir of work ahead of him and behind him, there will be times when he is idle through no fault of his own.

In the case of the individual-job type of industry—such as the machine shop, where each worker is, so to speak, a crew unto himself—the reservoirs are represented by the delivery of the material, and by its removal after it has been processed. In the chapter on "Output" I cited typical instances in the cut and punch department of such a plant.

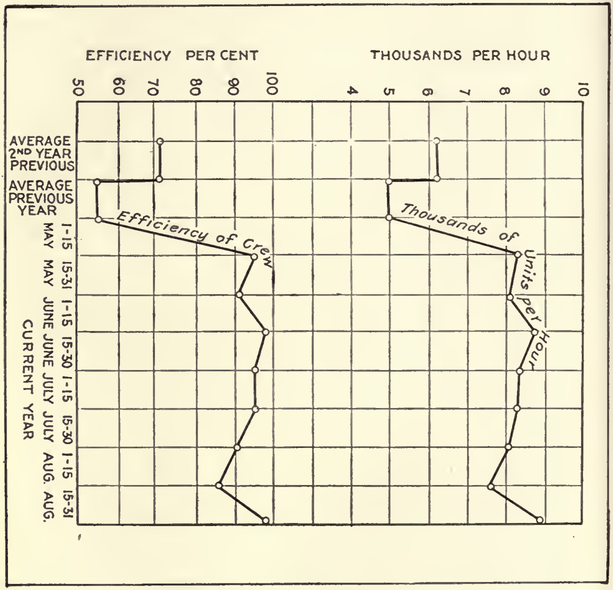


FIG. 44. CREW EFFICIENCY

Released from restraint, and rewarded in exact proportion to accomplishment, a crew of thirty men increased their efficiency of use of labor from 55 to 100 per cent.

Value of a Standard.—Enough has been said to make clear the importance of so standardizing conditions and so grouping the workers that each man may do his best. If the executive is to rest assured that the business is being conducted in such a way as to eliminate waste and so serve the best interests of the worker, the capitalist, and the community, it is quite as important that he know how nearly the predetermined standard is being attained—how effectively the labor is being used—as it is that he know whether men in excess of the number actually required are being employed.

First, it must be determined, then, by scientific analysis just how many men are needed on each crew,

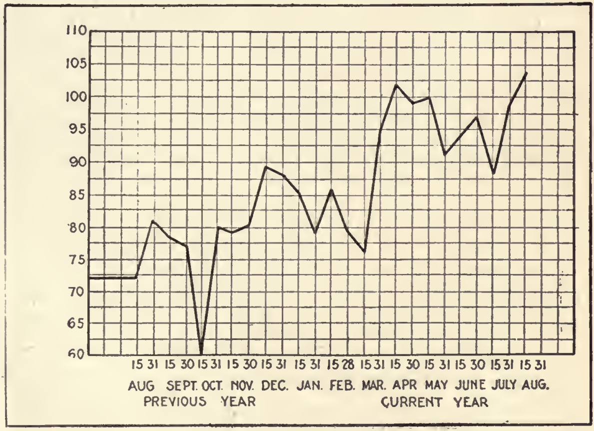


FIG. 45. CREW EFFICIENCY GRAPH

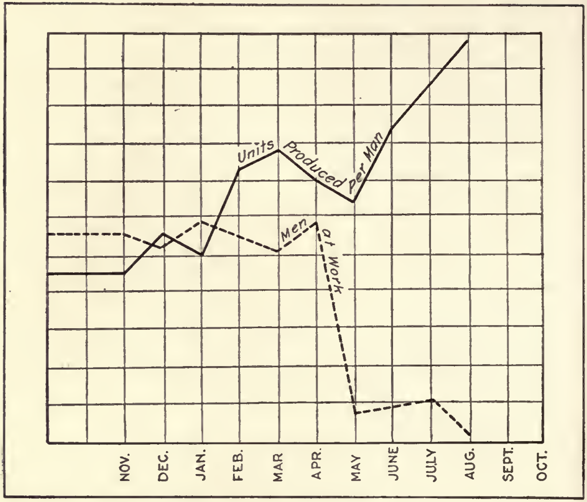


FIG. 46. CONTROL GRAPH, SHOWING UNITS PER MAN
Two actual examples are shown in Figures 45 and 46 of what was accomplished in a crew and in a factory by the application of the methods described in the accompanying text.

just how such men should do their work in order to spend their labor most effectively, and it must be made possible by standardization of equipment and of conditions to have the work done in this way; moreover, matters must be arranged so that it will be to the advantage of the crew to do the work as prescribed. It will be possible then, and only then, to state in a word just how nearly what actually is being done compares with what should be done.

The advantage to the executive of thus boiling

down the daily, weekly, and monthly accomplishment of each crew to a single figure—the percentage of effectiveness in the expenditure of labor—cannot be overestimated. In the case of the work of our setters of sewer pipe, for instance, the executive cannot stand there all day and note just how well the work is done. Even if he hired a foreman to supervise the men, how could this foreman, and all the other foremen, report to him at the end of the day in words which would convey to him exactly how closely the work of each crew approached the best that could reasonably be expected? It would be impossible, even if he had time to listen.

Once the standard has been set, however, he can be told in terms of a percentage just how nearly the work approached the standard. Such figures can be charted daily, weekly, and monthly (Figures 44, 45, and 46), and a glance at the chart tells the executive, much more quickly, exactly, and adequately than any foreman could, the precise status of every department of every factory and of the whole operative organization.

CHAPTER XIV

THE EFFICIENCY OF USE OF LABOR—

(Continued)

Economic Waste Too Common.—In the last chapter we examined certain laws underlying the use of labor in industry. In so doing it may have seemed that there was a certain reversion to the old system of "shoving the work onto the men" and supplementing the gad with the carrot in such a way that the advantage was only to the employer. I cannot adequately cover this phase of the matter in the space allotted to this part of industrial control—a few examples will therefore have to serve my purpose.

In a large automobile-accessory factory a workman, on leaving, said to the men who had been setting piece rates in the old fashioned way—by precedent, by guess, and by bargain—"I don't mind telling you now, that your rate is too high. You've been paying me twelve cents apiece when two and a half is enough. The reason I'm tellin' you is that I've got it in for the fellah who is followin' me on the job." The new rate was set at two and a half cents, and the "fellah" mentioned made nearly five dollars a day. The original workman could have made about twenty dollars a day if he had dared to let himself out! In the same shop another man, when he left, sold to his successor for over seventeen dollars the pieces he had

machined but did not dare turn in for fear of a cut in his piece rate.

A woman nailing boxes in a shoe factory invented a hammer with which she could drive a nail to the head with a single blow. She could have made ten dollars a day, but only dared do work enough to net her three and a quarter. Instances of this sort could be cited indefinitely. Do you think economic waste of this sort can be anything but a tax on the community, or that it adds to the employee's "satisfaction with work" or to his pride of accomplishment?

The Zest for Work.—What drove England's millions into the army under the volunteer system—big pay and a chance to loaf? or the desire to be able to feel a pride in what they were doing? Does a man perform an act of exceptional bravery in order to win a bigger salary through promotion, or to secure greater satisfaction with self? Does a man value the Cross of the Legion of Honor because of the worth of the metal in it, or because his pride swells every time he looks at it?

William Jewett Tucker, in an article in the Atlantic Monthly, reviews the changes in industrial conditions in the United States for the past fifty years which have led to the awakening of what he calls the social conscience—"a general awareness of, and desire to correct, conditions unfair to the wage earner." He reaches his climax in the question: "Why has industrialism robbed the individual and society of the inestimable boon, the zest for work, which is present when the profits of a man's labor are wholly his own?"

The solutions of the problem of social unrest offered by trade unionism and by socialism—the one demanding higher wages and shorter hours, and the other public ownership—are examined by Dr. Tucker and are rejected as failing to provide the basic remedy, "a consistent means of increasing satisfaction with work."

Bruno Laskar, a trained investigator, in furnishing England with material of value in the shaping of a national labor policy at the close of the war, makes the following statement:

> The workers can be victorious in this battle (between capital and labor after the war) only if they adopt the underlying principles of scientific management themselves, for their own protection, if they abandon voluntarily such outworn methods of industrial warfare as the limitation of output and the vigorous classification of workers into skilled and unskilled, and substitute for them a spirited fight for participation in management.

Systematic shirking bores the average working man to extinction. Work is defined as onerous exertion, yet the workman will play baseball until he is in a dripping perspiration, and will at the same time yell his head off with pure joy. No work is any more grinding and monotonous than training for a college football team, and the danger to life and limb is quite as great in that sport as in most gainful occupations. Yet we don't hear of athletic teams limiting their output and indulging in systematic slacking—they have zest for their work.

E. H. Sothern, in the autobiographical account of his early struggles, makes these interesting comments:

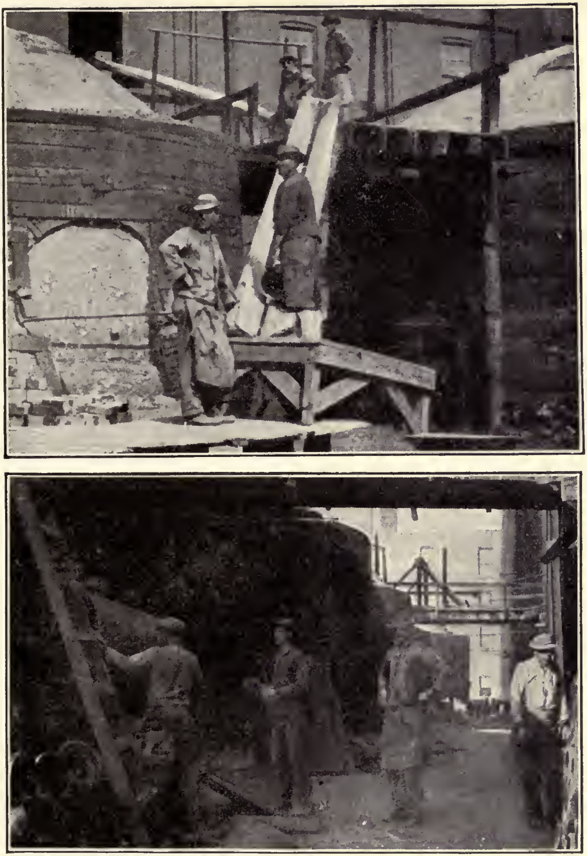


FIG. 47. INEFFICIENCY IN THE USE OF LABOR

These are piece rate workers whose work is not standardized. Note the tired, uninterested expression on the men's faces.

I had a fine time doing my work. I was entirely engrossed in it, it quite possessed me every waking hour. To practise my calling and to feel myself become more expert day by day, became a passion with me—a gratification far beyond the possession of wealth, and I say that such a passionate obsession, and joyful abandonment, and unselfish slavery belong to art alone.

Oscar, of the Waldorf, in an interview a few years ago, made the following contribution to this subject:

I am glad that I soon had sense enough to see that specializing and giving no thought to anything beyond my business was the straight road to success. When I had so seen, the hotel life became my exclusive occupation, my whole life's chief concern.

And the late E. H. Harriman went on record as follows in regard to a man's relation to his work:

I have often wondered whether it was worth while—but there is something in a man that makes him want to go on, to finish what he has started.

And finally, Smith, my friend who is a mechanic in a small factory, witnesses to the real pleasure of work. Working overtime, with bits of scrap iron and a discarded motor he created a machine for handling heavy tile, a thing almost human in its ingenuity. He did things with it for me. He uttered no aphorisms, but I know that no actor, no maitre de hotel, no capitalist, ever enjoyed a zest for work any greater than that which lit the fires of happiness and contentment in that simple workingman's face. In the case of these four men whom I have mentioned, what place have systematic slacking, limited output, social unrest?

FIG. 48. PIECE WORK—UNSTANDARDIZED AND STANDARDIZED
Try standing around, as the men in the upper picture are doing, for fifteen minutes with nothing to interest you. Compare with the same crew as shown in the lower illustration after work is standardized and men placed on bonus.

Scientific Management and the Worker.—If scientific management will supply the place of Colonel Bogey on the golf links, of the score board in baseball, of the joys of the game—team work and emulation—by furnishing a definite mark to shoot at, by displaying the worker's efficiency and skill so that all may read, and by encouraging mutual co-operation and assistance—and it will—why should the laborer be denied this "consistent means of increasing satisfaction with work"?

The great corporation, trust, monopoly, or whatever popular invective may happen to term it, is here to stay. Mr. Morgan was right. Eggs cannot be unscrambled. Competition and the small business as our grandfathers knew it, cannot be restored. This is an age of organization and of specialization. When seventy million Germans held the world at bay by sheer organization and efficiency, no sane man can demand a return to the methods of our grandfathers. We are nearly all of us directly or indirectly working for the great corporation. We can no longer seek our own reward in the praise of the satisfied customer, as did the village shoemaker, or in the selection of the fruit of our loom for the altar cloth of our village church. It is not the money that puts joy into work —it is the praise of those we respect, of our friends and of our inner consciousness, and the efforts of our peers to emulate our accomplishment.

Thousands of workers on railroads, and in steel mills, automobile factories, and department stores—men engaged in every sort of industrial activity, from shoveling to salesmanship and business administra-

tion, have in effect been set up in business for themselves by the application of the principles of scientific management. When the expert has analyzed each motion of the laborer, and, using the stop-watch or the cinematograph, has determined just how much work he can do without injury to his health, has taught that laborer how to do his work with the least possible fatigue and in the most effective manner, and then has made it worth his while to reach the standard set, by paying him exactly in proportion to what he accomplishes, as to both quality and quantity—then the expert has made the laborer very nearly sole proprietor and administrator of his job.

Under the scientific system the workman is in many cases better off than the former owner of the small business, because the payment of his day wage insures him against undue risks. In addition, not only is he furnished all the incentives of the small shopkeeper through the sure reward of his industry, ability, and ingenuity, but he secures the services of an expert advisor. The payment of a bonus for the quality of his work furnishes him with that zest for work with which the praise of the satisfied customer formerly stimulated the artisan. Then, too, the knowledge of just how nearly he is approaching the carefully determined standard and his percentage of efficiency as compared with that of his fellows, supplies him with those elements of emulation and joy in success which give games and sports their fascination. A good day's work receives its due reward automatically and surely in that increased self-respect which follows accomplishment, in the praise of

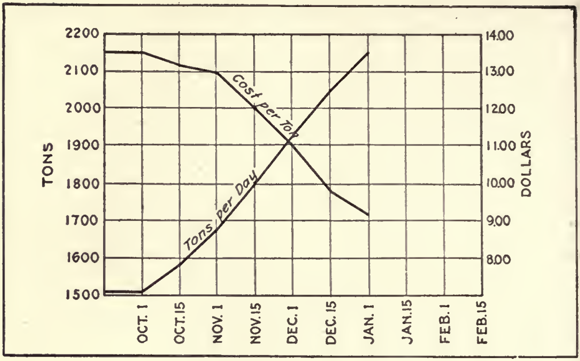


FIG. 49. COST-OUTPUT CHART, INSPECTION DEPARTMENT

What standardization and bonus did to the cost per ton in an automobile factory.

comrades who appreciate successful effort, and in hard, round, spendable dollars. Why should we deny the modern factory worker all we can give him of the advantages enjoyed by his forefathers, both in the added zest for work and in the opportunity to share in the profits of his endeavors in proportion to what he does?

Scientific Management, and Justice.—The systematic survey of a plant is, moreover, a great promoter of justice. A timekeeper in a certain plant in which some industrial engineers were beginning their work, not long ago made to me the following suggestive comment: "Gee, I'm glad you fellows are coming in here. I was over at the ——— Company when you did your work there, and we were all glad to see some

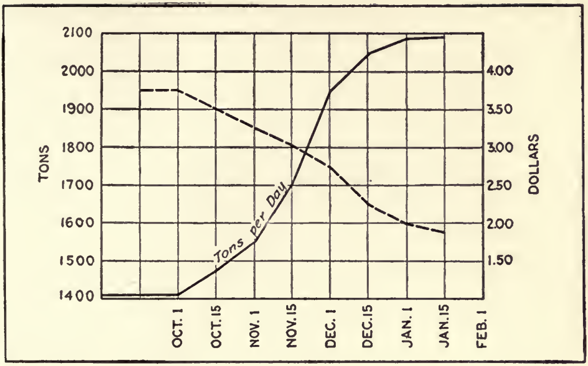


FIG. 50. COST-OUTPUT CHART, TRUCKING DEPARTMENT

Another example of the effect of standardization and bonus.

of those big fat slobs who had been coming down to work at nine o'clock and spending their time smoking big fat cigars in their private offices get busy. And you can take it from me there's a lot of 'em need the same thing here!"

At another plant a man who, because he was over sixty, and because he looked like a fossil, had been thrust aside as useless, was brought back into the active life of the business and he put on an efficient basis a department that had been rapidly going to pieces. At the same plant, a youngster whose energy had been misinterpreted as freshness, and who was just on the point of dismissal was loaded up with work—which was what he needed—and within a year became one of the company's most valued executives at more than twice his original salary.

At one of the largest factories of its kind in the world, the man in charge of the stables—whom every one regarded as an instinctive horseman, largely because he was a Southerner—was investigated quite early in the game because the management thought he might be prone to too much Southern hospitality when it came to dispensing feed and stable supplies. When we looked into the matter, we found one of the most scientifically conducted stables we had ever seen in all our experience. That one-eyed Missourian could have gone into the efficiency business himself, and could have backed off the map most of the efficiency engineers I have known. He was weighing every bit of feed for every mule and every horse. Each Sunday he weighed every animal under his charge. He had the judgment of a veterinarian, combined with the interest of the true horse-lover. To these two qualities were added a keen sense of economy and a strong regard for his employers' ultimate interests. And he had everything down in a book—just what combinations of feed, and just how much feed he had given each animal on each sort of work over a period of years, and what the result was in each case. What more could you ask from the most scientific of scientific managers? And yet the management thought he was wasteful, until the investigator came along and helped him into his own!

Nothing discourages a conscientious man so much as to see a loafer getting ahead of him through bluff or through pull. Men of ability are often thrust aside because they are "not mean enough." Older men, who can still perform their duties excellently,

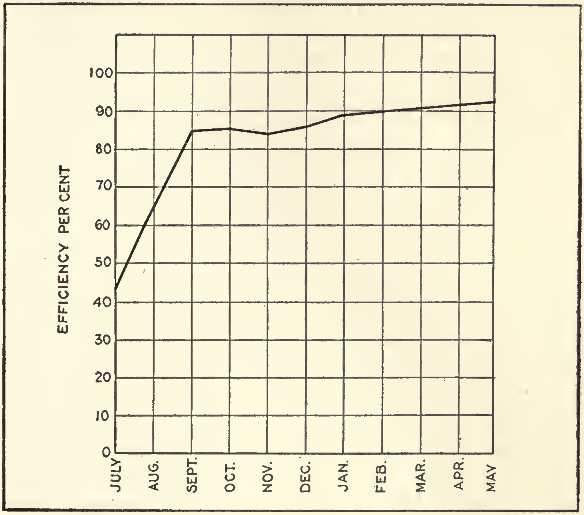


FIG. 51. DEPARTMENTAL EFFICIENCY CHART

Showing just how nearly what was done in the department every month approached what should have been done. The percentage tells the executive exactly the condition.

and who possess a fund of knowledge that should be utilized fully, allow themselves to be thrust aside by the "pushy" youngsters. Young men who do not realize, as did Thomas W. Lawson, that "It was a great day for fools when modesty was made a virtue," keep their lights well under a bushel, and the company is the loser. The bluffer, the sycophant, and their tribe—men who have wormed their way into power through politics, rather than through merit—

cannot withstand the impersonal, analytical, relentlessness of the scientific method when it is applied to business management, and their loss means justice to real ability and increased earnings for the company.

Interest of the Worker an Asset.—Aside from the ethics of the question, the interest of the worker in his work has very real advantages from the standpoint of the executive and of the stockholder. Men who are satisfied with their work are less likely to strike—and strikes are quite as costly to the employer as to the employee. In addition, filling a plant with the slave-driving or with the sleuthing type of foreman—with slave drivers or spies sufficient to force every worker to his limit—is not only very expensive, but is likely to lead to trouble that will be even more expensive. If the money that is so squandered in supervision—and economic waste is ultimately paid for by the consumer—can be paid to the workman to get him to supervise himself, the employer gains in the reduction of overhead expense quite as much as the worker does in wages. (See also Chapter XI.)

Moreover, the ease with which the executive can control a plant organized according to the principles of scientific industrial efficiency, as compared with a plant "organized" under the chaos of casual management, may be compared to the ease with which a skilled driver handles a well-trained four-in-hand, as against the difficulties encountered by a novice who tries to handle a team of unbroken colts. The first type of organization requires merely the guiding and trusted touch upon the reins from time to time, while

the other requires full strength—and then, as Bradstreet's figures prove, ends in disaster about ninety-nine times out of a hundred.

Value of Statistics.—Irrespective of efficiency gained through conservation of energy, which will no longer be lost in useless friction, the statistics that come to the executive in the standardized shop mean much, and are comprehended quickly. By way of illustration I give the following tabulation:

SWITCH SHOP

Operation	Actual Cost	Former Piece Rate Cost	Actual Saving	Percentage	Percentage of Average Efficiency
1. Bending and Laying Off	$ 9.70	$11.08	$ 1.38	12	109
2. Planing Switches......	17.44	32.24	14.80	46	90
3. Planing R. Bars.......	2.10	3.42	1.32	40	73
4. Miscellaneous Drilling.	2.04	2.48	0.44	17	70
5. Switch Drilling........	4.84	6.26	1.42	22	106
6. Riveting, Bolting......	5.28	5.77	0.49	8	65
7. Blacksmithing.........	0.48	0.89	0.41	46	74
Totals..............	$41.88	$62.14	$20.26	32	90

These figures tell the executive just what the work is costing in every department, just what the saving is over former methods and, most important of all, just how closely the work is approaching the realizable standard in terms of a percentage. Enter such figures as these upon a chart each month, and the chief executive has the reins in his hand, with time enough to look about him, to consider the future as

well as the present, to devote his energy to the big problems of the business that determine its ultimate destination. The result can only be better satisfied workmen, better satisfied executives, and better satisfied stockholders—and upon these three groups depends the prosperity of the community.

CHAPTER XV

THE EFFICIENCY OF USE OF MACHINERY AND EQUIPMENT

Improvement versus Innovation.—About ten years ago a Californian whom I met on the Shasta Limited told me his experiences in canning fruit for Fred Harvey, the man who carried metropolitan hotel service to the Southwest along the Santa Fe. My friend stated that every quart can of peaches bought by the railroad's purchasing agents had to contain a certain number of half-peaches—otherwise the fruit was rejected. The reason for this was that Mr. Harvey had determined that with peaches of a certain size three halves made a generous dish. If a slightly smaller peach were served, it was necessary to furnish four halves, which meant that fewer customers could be served from a can, and since peaches are bought by the can, the cost per dish to the restaurateur was higher and the profit per dish less. This is one sort of standardization.

Industry in America has been a sort of coral growth. Starting fifty years ago, with a few pioneers who dared to purchase a steam engine and a few machines, our factories have grown up piecemeal. Each machinery manufacturer and each superintendent has added his bit to the structure, and departed. We are temperamentally an ingenious and

an inventive nation, and improvements in processes and in machines have been many. Unfortunately, however, sometimes we have made changes for their own sake, mistaking innovation for improvement.

Irrespective of whether the changes have always been for the better, the numerous and frequent changes that have been made have resulted in an endless variety of machinery and equipment. This variety is responsible for innumerable difficulties both in manufacture and in maintenance. If all the drill presses in a plant were the same—would do the same work at the same speed—a certain piece of work that required drilling could be scheduled to any machine and could reasonably be expected to be ready for the next operation within a certain time. If, as is often the case, the work must wait for a certain press, or group of presses, to be done economically, or perhaps to be done at all, the scheduling becomes a much more complicated matter. Furthermore, congestion at certain machines that are most in demand is likely to result. Perhaps, in consequence, the piece is not finished in time, and the other parts must all be held on the assembly floor until it arrives. As a result, delivery is delayed and various costly makeshifts must be resorted to.

Accurate Standardization.—If, on the other hand, all drill presses in a shop can be remodeled and classified so that all the machines in each group can be counted upon to do a wide range of work, in a known time, the progress of work through that shop at once becomes orderly and steady, and the effect upon the output and upon the cost of production is immediate.

The same principle applies in regard to any other sort of machinery or equipment. Take, for instance, the case of furnace work as illustrated by the following statement of an actual situation which prefaced a recommendation for a standardization expenditure:

1. Theoretically, there can be only one "best" type of kiln for each class of product that you produce—only one type that will turn out the greatest percentage of first-class product with the least coal and with the least labor.

2. While the logic of this theory is beyond question, practically there is a certain amount of variation in type and in dimension which may be allowed without materially reducing the burning efficiency stated above. The need for determining exactly the limits of this variation, will become more and more evident as the exactness of the burning methods is increased by the analysis of the burning conditions and methods which the records and the technical apparatus installed now makes possible.

3. While it would be very easy to state categorically that a certain type of kiln bottom would produce the best results, and to recommend that all kilns be changed without delay to conform to such a standard, the cost of such a procedure would be prohibitive. The problem, then, is to determine the least amount of alteration necessary for each kiln, and to plan and conduct that alteration in such a way that it can be made at the least cost and with the least interruption to the output of the plant.

4. The advantage of having all brick kilns constructionally conform to one standard, and all hollow-ware kilns also conform to one standard is, briefly, this:

a. There is one type of kiln that will turn out the best product, for physical reasons—because it distributes the heat most evenly, because there is not too much radiation from the crown, because the flash-walls are just the right height to protect the product, and so on.

b. There is one type of kiln that will turn out this product with the least consumption of coal, for physical reasons—because there is the least loss of heat through radiation,

because the least time is required to drive the heat to the bottom, because the kiln holds the most product per cubic foot of kiln, because most of the heat in the gases is utilized in heating up the ware before the gases are wasted at the stack, and so on.

c. There is a distinct advantage, from the standpoint of efficiency of labor, in having all kilns conform to one standard. Not only is there one type of fire box which is the easiest and most economical to fire, with the labor and the coal that you have, but your men will produce more uniformly satisfactory results if the kilns are nearly enough alike so that a certain act on their part will always produce a definite and uniform result. If every kiln is different from the rest (see Figure 52), it is not humanly possible to remember from burn to burn the exact treatment to which each kiln

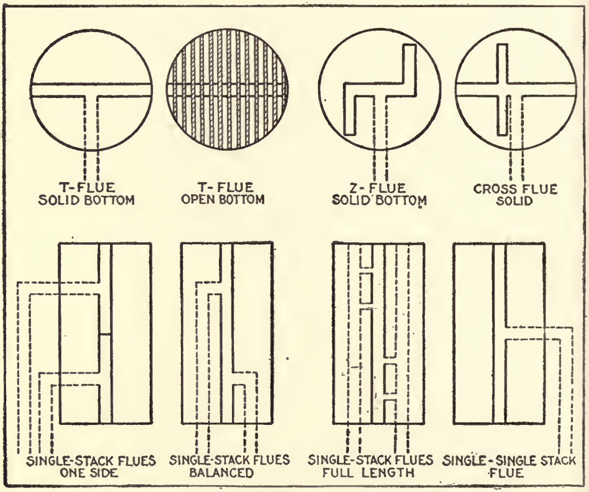


FIG. 52. UNSTANDARDIZED EQUIPMENT
Varieties of brick kilns at one factory—only flues are shown.

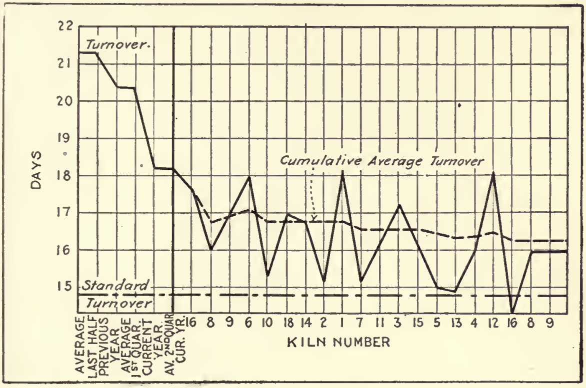


FIG. 53. CHART SHOWING RESULT OF FURNACE STANDARDIZATION

responds to the best advantage during every stage of the burn. There are enough unavoidable variables without adding to the difficulties of the situation by having any more variation in type and in dimensional proportion than is absolutely necessary.

At the time this statement was written the burning time was varying as much as 200 per cent in some instances—with the same coal and the same labor. The difficulties of carrying out, under such conditions, the production planned, can readily be imagined. The result of the seventh month's standardization work that was put through is charted in Figure 53, from which it will be observed that the extreme variation had been cut down to about three days, and the average turning time had been cut from over twenty-one days to about sixteen days. By the end of July it was possible to schedule the product with some de-

gree of certainty that the finished ware would be ready for delivery when promised.

If you plan to have a certain product ready at a certain time, if you have your men all ready for it in subsequent departments, if your customer is planning to make use of it at a certain time, and then some one process takes twice as long as you expected, the result is disastrous. An automobile plant I visited not long ago, in which standardization has been carried to as high a point of perfection as in any factory in the country, had service cards made out and dated for work to be done six months later. Contrast this system with that of the concern so organized that the foremen amble around each morning and "hunt up something for the men to do!"

Reducing the Number of Delays.—Some of the worst foes to the performance of work on schedule are the delays caused by breakdowns and by lack of material. The accompanying chart, Figure 54, shows the reduction of the number of such delays in one department of a large factory. It will be noted that the total average machine-hours delay shown for each month in the lower part of the chart, was gradually reduced from sixty-five to twenty hours per month. The cause of these delays is shown by the curves below the line marked "Total." The upper half of the chart shows the reduction in a percentage of the total working time of the department (twenty-six ten hour days are figured to each month).

The reduction of the number of interruptions of this sort requires endless attention to detail. Let us notice, for instance, the reduction of the number of

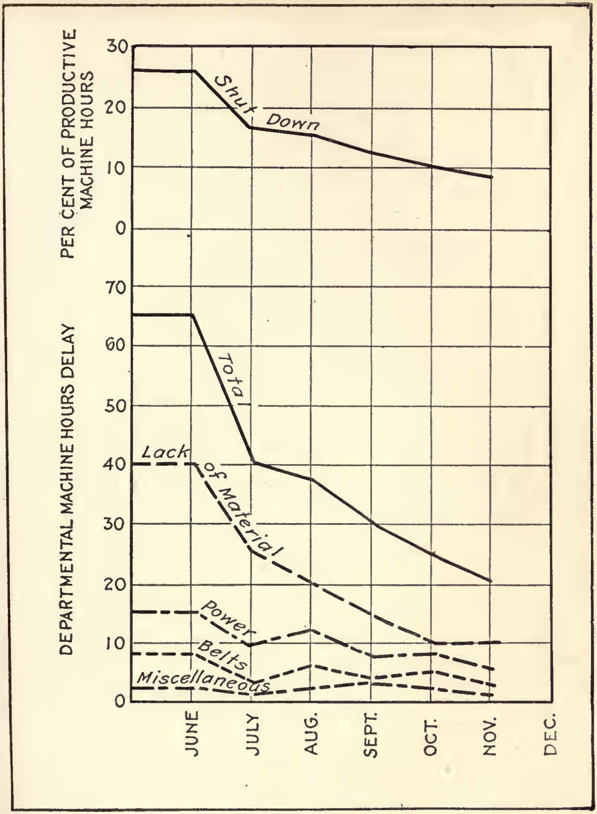


FIG. 54. CHART GIVING INFORMATION OF MACHINE SHUT-DOWNS

The chart also shows the executive how to reduce the number of such interruptions to output, by directing attention to the causes.

delays due to belt failures. Usually belts are repaired after they break; but scientific management demands that belts be repaired before they break. Only in that way can interruption to output be avoided. Such a program demands functionalized repairs. Just what that means is perhaps best illustrated by the following quotation from an actual standard-practice recommendation:

STANDARD PRACTICE RECOMMENDATION

BELT RECORDS

We have several recommendations to make in connection with reducing delays, the first of which is the introduction of Belt Records.

Practice has been to wait until a belt fails before repairing it, and then to repair it by whatever means are at hand, usually after a temporary fashion. Furthermore, whoever happens to be running a machine is called upon to do the work, except in a particularly difficult case. The natural result has been that nearly all the belts in the plant have deteriorated to a point where breakdowns are always imminent.

To eliminate this faulty condition, we suggest that one man be appointed custodian of the belts, and that he be given a supply of Belt Record Cards on which to record all the data necessary for maintaining the belting at a proper standard of condition. This work should not require all the time of one man; but he should be given to understand that it is his first and most important duty.

Use of the Belt-Record Card.—In order to have a written description of each belt in the plant, together with a record of all repairs, renewals, and so on, a belt-record card has been drawn up. The data for these cards are first supplied by a careful survey of all the belts, one card being made out for each belt. At the start, all the important dimensions, speeds, horsepower to be transmitted, pulley diameters, and so on, are entered at the top. From then on, all work done on a belt is described in the columns below, from which record it is pos-

sible to tell whether or not the belt is giving trouble or is wearing out too quickly. If the performance is not satisfactory, steps can be taken to better the conditions under which the belt is working.

Weekly Inspection of Belting.—In order to anticipate and prevent breakdowns, which are the big factor to be considered, the belt man should inspect every belt once a week. He can best do this by following a regular route through the plant, examining a few belts each day so that by the end of a week he will have inspected all of them. Any belts found to be in poor condition should be repaired at once.

Care of Belting.—Among the most common causes of the destruction of belts are the following:

1. The belt is too wide for pulleys, so that part of the belt runs beyond the edge of the pulley, causing the edges to fray.

2. Misalignment of pulleys, causing the same trouble.

3. Poor shifting devices, the fingers of which catch in the belt joint and tear it.

4. Poor fastenings, often out of square, which cause one side of the belt to be tighter than the other. Sometimes the fastening is poorly made, so that it introduces a spot in the belt much weaker than the rest of the belt.

5. There are too many pieces to the belt. Lack of proper care often results in a belt's finally being made up from three to eight separate lengths, all fastened together with hooks. A belt should be in one piece, or, at the most, in two pieces.

6. The use of belt dressing containing resin, which is effective in an emergency, is only a temporary relief, and results in injury to the belt. If the belt is large enough, no dressing of this sort is required.

7. Failure to clean and oil belts at regular intervals. Belts are allowed to soak up oil and dirt until they fail to take a proper grip on the pulleys. The result is slipping and burning.

8. Belts are too loose, so that they flap and run back and forth across the pulleys. A tight belt will transmit much more power, and will last several times longer, than a loose one.

The remedies for these faults are suggested by the faults

themselves. But to insure that the belts will receive thorough and systematic care, it is essential at all times to have one man in charge of them, a man who will make repairs before, and not after, breakdowns occur.

The accomplishment in one case under this system —as illustrated by the reduction of the number of belt failures in one department of a large Eastern steel company—is shown by the accompanying chart, Figure 55.

Similar Laws For Machinery and Labor.—In general, very much the same laws apply in the case of machinery and equipment as do in the case of labor.

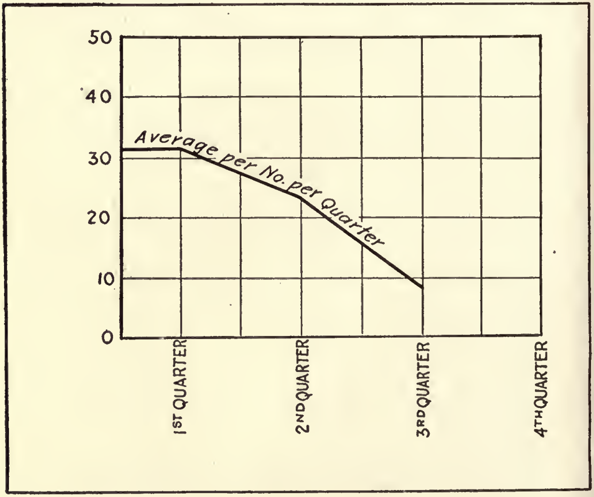


FIG. 55. BELT FAILURES ON ALL MACHINES IN ONE DEPARTMENT
Each failure means an interruption in the output. Standardization and functional repair crew organizations affect the reduction.

The first questions for the executive are: "How many working hours are my machines busy each day? In other words, what is the 'efficiency of supply'? Have I more machines than I need? If I have, had I better sell them or had I better alter my business policy in some way so that I can work them a greater per cent of the time?"

Not long ago a printer called in a firm of engineers to find out where he was losing money. As he expressed it—"I know exactly what paper costs me and what ink costs me, and I know how much labor it takes to do a job. It seems as if I ought to be able to sit right here at my desk and, by adding ten per cent to the cost of doing every job that comes in, be able to make a good profit. But lately I have not been even holding my own."

Investigation showed that the business was being run largely on borrowed capital and that only about one half the equipment was in continuous use. In other words, the printer was paying interest on $50,000 at 6 per cent and only about $25,000 worth of equipment was working for him. In effect, the outgo in interest was $3,000 a year (6 per cent of $50,000) and the income was $2,500 (10 per cent of $25,000). The engineer's advice was, "Stop sitting at your desk and get out and hustle enough business to keep all your machines busy."

A friend of mine was once called in to pass upon the expenditure of $150,000 for new machines in a concern employing about two thousand men. Not only did idle-machine records show that the new machines were not required, but two years' standardiza-

tion resulted in an increase of 60 per cent in the plant's output without any addition to the equipment whatsoever.

In this case the executive's question as to the efficiency of supply of equipment was answered when the engineer said, "Don't buy any more machines. You aren't using what you have". The executive's second question, "What is our 'efficiency of use'?" was answered when the engineer, by means of standardization, increased the output 60 per cent. The two main questions then which concern the executive, are:—

1. Am I using all my equipment all the time?
2. How effectively am I using my equipment?

Effect of Equipment Upon Labor.—Aside from the feature of overhead, interest on investment, and so forth, there is the very vital question of the effect certain types of equipment have upon the effectiveness of the labor employed. The accompanying photographs, Figures 56, and 57, furnish some horrible examples in this connection.

The first two show crews of men removing sewer pipe from the kiln. The management of this particular plant had been laboring under the impression that the flow of product was "squeezed" at the kilns. As the superintendent expressed it, "We haven't got kilns enough—so we put on enough unloaders to just eat the pipe." The result of this attempt at forced feeding was the acute industrial indigestion shown by the photographs. Men in the kiln rolled pipe to men at the door. Men at the door rolled them to men on the chute. Men on the chute rolled pipe to men on

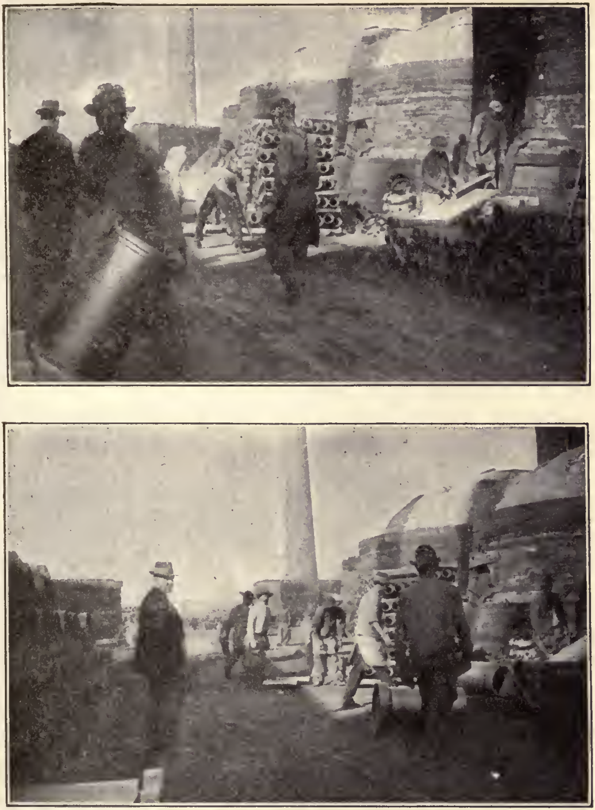


FIG. 56. UNSTANDARDIZED CONDITIONS
A large crew of men rolling the product or carrying it instead of wheeling.

the ground—who rolled them to still other men on the ground, until the poor, mishandled pipe, frayed, dusty and ragged, reached the men at the pile. The clatter was terrific, and the crew resembled nothing so much as monkeys climbing over one another in a cage.

Out of the nine men shown in the first photograph, three are actually doing something. The other six are dedicated to strenuousness and haste. The second picture shows eight men. Try to find one who is accomplishing anything. The efficiency of the crew is about equal to that of the unfortunate loser of an election bet who undertakes to propel a peanut down Main Street with his nose!

Figure 57 shows the same sort of pipe being unloaded after the equipment was standardized—and the crew incidentally cut in half. It will be observed that we have one man moving eight pipe, on a barrow, instead of eight men rolling one pipe on the ground. Note also the difference in the attitude and expression of the workmen.

Figure 58 illustrates the acme of unstandardized equipment. By courtesy, the vehicle shown was known as a "dump-car." You will observe the two colored gentlemen holding it up as their co-laborer shovels the material out onto the ground. Everybody was working hard except the mule, who was enjoying a rest period. Under the circumstances we can only mark the labor 100 per cent efficient, as far as effort goes. The efficiency of the equipment is somewhere about the vanishing point.

Standardization Solves the Executive's Problems. —The executive, then, who would insure the most

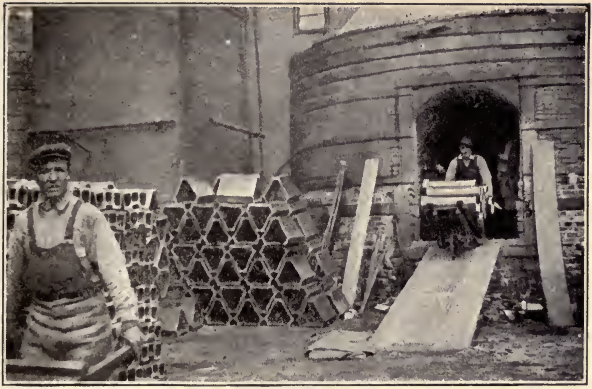


FIG. 57. STANDARDIZED CONDITIONS

The same product as in Figure 56 at the same plant. Note the changed morale of the crew now on bonus.

FIG. 58. THE ACME OF UNSTANDARDIZED EQUIPMENT

A three man dump car—not to mention the mule.

effective use of the machinery and of the equipment in which the company's money is invested, must be able to assure himself at all times that the maximum amount of it is in use. Further, he must be certain that the machinery in use is being utilized to the best advantage. Finally, he must be satisfied that the equipment which is being used effectively is of the kind best suited to the work which must be performed. The answer to all these questions is standardization. Once standardization has become an accomplished fact, his departmental-efficiency charts tell him just how nearly each department, and the whole plant, approaches the predetermined task—the practical ideal that has been set up as a reasonable goal for the man, for the machine, and for the management.

CHAPTER XVI

GRAPHIC TECHNICAL CONTROL

Scientific Method Applicable to Every Plant.—In an earlier chapter I quoted the Federal Trade Commission in regard to the two general methods of manufacture—the job system and the continuous-production system. Sanford E. Thompson, in the Bulletin of the Taylor Society, states the situation more fully as follows:

Every plant presents the necessity for all the principles I have indicated (*i.e.,* Dr. Taylor's basic principles of Scientific Management), but the principles vary as to relative prominence in different plants. Considered from the point of view of method of attack and manner of treatment, industrial plants may be considered in three groups, in which variously predominate:

(1) Scientific research, required for a plant where production is handled as a whole by a continuous flow, as in a paper mill or in a pulp mill, or a cement mill, and where the principal study must be devoted to standardization of methods and improvement in quality.

(2) Planning and routing, required as the first essential where, as in a printing shop or a shop manufacturing miscellaneous but standard products with independent machines, these also involving much detail because of small orders or numerous parts.

(3) Analysis and detail instruction, required as the chief essential, such as in a machine shop, along with complex planning and routing.

The point which I wish to emphasize is that "every plant presents the necessity for all the principles," even though "the standardization of methods through scientific research" looms largest in connection with the continuous-production type of factory. I have already defined and discussed the scientific method. The application of this method to various processes of manufacture and the method of their subsequent control by the executive, forms the subject matter of this chapter.

"Speed" Parkin—one of Dr. Taylor's assistants in his experimental work in cutting metals—an expert who can probably get more production from any given machine than any other man in the country, had a fixed rule of procedure: "Increase the speed, feed, and depth of cut until the machine busts, set her one notch back, and then proceed." While I would not advise the novice to take this advice too literally, I realize that it leads us to the consideration of the facts that there is some point at which most machines "bust," and that different types of machines "bust" in different places. "Speed" Parkin would have had to modify his rule if the scientific method had been applied in the construction of metal-working machinery as thoroughly as it was supposed to have been applied in the case of the famous "one-hoss shay." It will be recalled that every part of that wonderful rig was so perfectly constructed that, instead of wearing out and breaking down in one weak point after another, as its predecessors had done, it all wore out at once and collapsed under its owner. Seriously, the point is this: Had the scientific

method been applied to the design of metal-working machinery in the beginning, instead of each machine being strengthened at one point after another, as each part in turn was found to be weak, the speeding up of machine production would have progressed much more rapidly, and there would be fewer "lame ducks" in every machine shop today.

Scientific Methods, Not "Trade Secrets."—Most machines and most processes are the result of gradual growth under the sway of that powerful reactionary voodoo, "years of experience". We have seen what happened to that fetich in the case of bricklaying when it came in contact with the scientific method. Cold-blooded analysis of almost any condition or process to which the method has not been previously applied, will yield startling results.

In the old days of pottery-making, the manufacturer hired a glaze-maker who retired to a locked room and with great secrecy mixed together certain ingredients, into which the unburned plates were later dipped in order that they might take on the glaze that makes plates and similar articles impervious to moisture. The owner of the factory never knew what it was that made his china saleable. In spite of the fact that a large amount of experimental work had been done which cost him much, in wages and in spoiled product, the knowledge of the glaze-maker was never accessible to the manufacturer. If the glaze-maker got drunk, the factory shut down. If the glaze-maker demanded ridiculous wages, he generally got them. The manufacturer was absolutely at the mercy of his glaze-maker.

The same state of affairs prevailed in other branches of the pottery industry. Kiln-burners jealously guarded their "secrets," and men in other departments who thought they could "get away with it," indulged in varieties of mumbo-jumbo calculated to impress the boss with their indispensability.

We have the same thing in "limited apprenticeship" in various trades. The English trade-unionist just began to learn, under the stimulus of war conditions, that limited apprenticeship and limited output must be replaced by unlimited co-operation between employer and employee, if the destiny of each, and of their country, was to be realized to the fullest possible extent.

In the pottery industry, the manufacturers were driven to establish trade schools where young men could learn the science of ceramics. These schools brought to bear on the subject the science of chemistry, of physics and of mechanics. Ignorance and prejudice were replaced by exact knowledge. Hokus pokus behind closed doors gave way to scientific methods practiced in the open. Men who, under former methods, could cover up their deficiencies at the expense of the industry, went to the trade schools. The result was the rehabilitation of the industry.

Scientific Management and Manufacturing.—As in the case of the application of the scientific method to any other activity, the first step in the application of scientific management to the control of manufacturing processes consists in the collection of data. As an instance of what the compilation of data will effect, I shall cite the example of what took place in

the foundry of a large steel mill in Pennsylvania. Investigation by an industrial engineer disclosed the fact that fifty per cent of the loss throughout the plant was due to cracked castings. Just what this loss amounted to, day by day, or just where it occurred, neither the foreman nor the officials of the company knew. They simply knew that there was a certain amount of loss due to cracked castings, that there always had been such a loss, and that probably there always would be such a loss. They considered it one of the necessary evils of the business, and charged their customers accordingly.

The investigator considered this loss excessive, and instituted the use of a series of diagrams to show exactly where the waste occurred in each case. Rough sketches were made, showing just where cracks appeared in each casting. Before long, the tabulated data showed that while cracks occurred on occasion in a good many parts of the castings, the majority occurred in a few especially favored spots. The reasons why the cracks occurred in these particular places were investigated, and the causes were traced back to their original source. The result was that the losses due to cracked castings were reduced from a total of fifty per cent in the whole plant to three per cent.

In an automobile-body plant, analysis of the output showed that the limiting factor in the flow of the product through the factory, occurred in the enameling department. The company had more work than it could do, and customers were clamoring for the product. The installation of new ovens was contemplated, but, owing to the layout of the plant, to

put them in would have meant serious loss of production while the work was being done. Data were collected concerning both just what was done in the enameling department, and why it was done, and recommendations were made. The general manager, who was a worshipper at the shrine of experience, and who therefore did not feel that suggestions emanating from any one who had not served years of apprenticeship as enameler, were worthy of serious consideration, sprang the slogan of his type—"It can't be done." The engineer's answer was, "We have been doing it for a week." The general manager walked out of the conference without saying a word more, and within six months the output of the ovens had been increased fifty per cent.

The very collection and tabulation of the data often goes a long way toward solving the difficulty. Notice the accompanying heat chart, Figure 59, for instance. This chart was intentionally arranged—in order to show up the absurdity of the situation—to look like the dress-making patterns our mothers used to cut from Harper's Bazar. In this particular case, the furnace men knew that sometimes the heats took a good deal longer time than they did at other times. They were not particularly concerned over the causes of such phenomena, since they were not paying for the fuel, and since their wages were in no way affected by the fuel consumption or by the monthly furnace output. If the management noticed the variation and made inquiry, the usual stock excuses about poor fuel and unfavorable weather conditions brought the investigation up short against a brick wall.

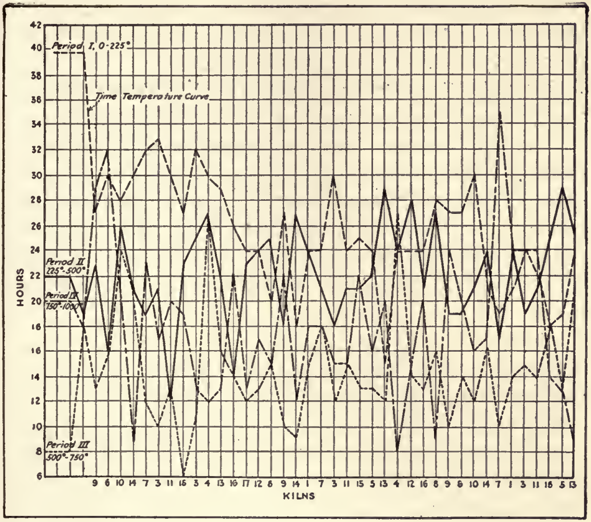


FIG. 59. HEAT CHART

Showing the existing conditions and their absurdities.

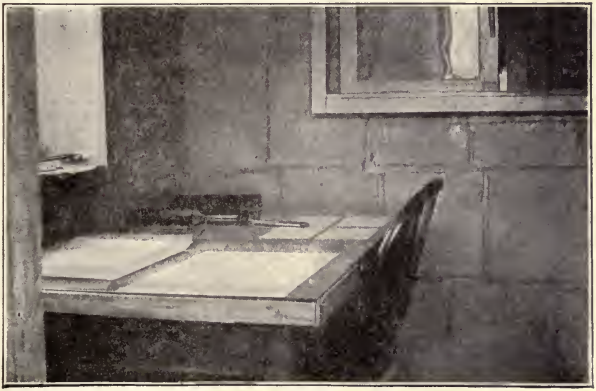
Technical apparatus with which to measure the temperature was installed, and the exact condition of the furnace every three hours was recorded. The process was studied and it was found that the temperatures between which certain changes in the product took place, could be fixed between definite limits. These limits are shown on the chart under Period I, Period II, and so on. With the same product, in the same condition, fired by the same men, with the same fuel, there was no excuse for a crazy chart such as

that shown. Other facts were, of course, collected at the same time, and the net result was a reduction of over forty per cent in the fuel bill.

Separate Department for Collecting Data.—In certain instances, the collecting of process data requires the creation of a separate department. This is especially true in the case of those operations which require a continuous follow-up—a planning and dispatching of their own—to prevent their interference with the operation of other departments as planned in the central planning department. Very often a branch of the central planning department can be combined to advantage, with the technical-control headquarters. Pressure gauges, galvanometers, and various other technical-control apparatus can be located in the same room as this sub-planning department, and the men who control the processes can thus be brought into intimate touch with those who plan the work of their department.

Figure 60 illustrates an instance of this sort. The right-hand building is the office of the chief dispatcher, and the one at the left houses the pyrometers and other technical apparatus by means of which certain furnace operations are controlled. The work of the furnaces is planned and dispatched from the same building by the "burning dispatcher," who works in close co-operation with the chief dispatcher.

Figure 61, shows the desk of the "burning dispatcher," located, in this instance, in a room adjoining the pyrometer room, previously illustrated. Upon it can be seen the various records and charts, some of them under glass, which are used in planning the



FIGS. 60 and 61. ABOVE: CHIEF DISPATCHER AND DEPARTMENTAL DISPATCHER LOCATED IN ADJOINING OFFICES
BELOW: DEPARTMENTAL DISPATCHER'S CONTROL DESK

work of the department. At this desk, the facts gathered by the application of the scientific method to the study of the process, were examined, and the laws governing the process were deduced. In addition, the work of the department was planned and fitted into the departments under the control of the chief dispatcher, who in this case could be consulted through the window shown in the right-hand upper corner of the picture.

Showing the Men Results.—Figure 62 shows one of the pyrometers by means of which the temperature of any one of the eighteen furnaces can be read at a glance by throwing a switch. The slide in the foreground holds the sheets upon which the men who are actually firing the furnaces record the progress of their work.

The importance of bringing the men who are actually doing the work into close contact with the apparatus which records its progress, cannot be too strongly emphasized. A man required to shovel coal from eight to twelve hours a day has, at best, a job of little interest. If, however, you can help him to see what he is doing, to understand why he is doing it, and if you can interest him in the results obtained, as fast as he obtains them, you are adding greatly to his zest for his work and to his satisfaction with his job. If you lock up your technical apparatus, he is likely to regard it principally as a means of spying upon his activities, and to expend his ingenuity upon devising methods of foiling it. If you can teach him that it is one of his own tools, put there for his convenience—a sort of automatic base-ball score board—by means

FIG. 62. TECHNICAL CONTROL APPARATUS FOR A MANUFACTURING PROCESS LOCATED IN A BRANCH PLANNING OFFICE

FIG. 63. A FIREMAN WHO BECAME A TECHNICALLY TRAINED MAN THROUGH THE APPLICATION OF SCIENTIFIC INDUSTRIAL EFFICIENCY

of which he can tell just how well he is playing his game, his attitude toward it will be entirely different. Moreover, his accomplishment by means of it will be vastly greater—especially if he gets a bonus at the end of the pay period for playing skilfully.

The next photograph, Figure 63, shows a furnace man operating a draft gauge. This particular man at first couldn't understand English, but once he comprehended the use of the thing, and once his interest was aroused, he came into the dispatch office with the regularity of clockwork, took down his gauge from the nail where it hung, trotted around from one kiln to another, took his readings, and wrote them down on the chart—quite as correctly as some of the technical graduates engaged in the same work, and with a good deal more pride.

Some of the best team work I ever saw occurred in the particular department in which this man was located. The policy of co-operation between the dispatching force and the firemen was such that luncheon was generally shared by them—a pail of hot macaroni from "Dago Hill" on the same bench with the lunch of the college graduate. What wasn't discussed at these parties wasn't worth discussing. The firemen got the partnership idea so strongly that it was almost embarrassing at times—for they were in partnership with the firm under their bonus system, and took an intense interest in all the firm's affairs. The climax occurred one day when Meoli sized up a new minor executive as "that fat fellow—rain in front, rain behind, 'no use to run'." Meoli was quite right about him. The executive was fat, and he didn't

know enough to come in out of the rain. The management several months later found out what Meoli had known all along—and "that fat fellow" was urged to depart. Such interest in a company's welfare is worth cultivating in the men. It is possible only when the latter are convinced that they enjoy the company's complete confidence.

Getting Results from Charts.—One of the department charts is illustrated in Figure 64. By means of the chart the "burning dispatcher" kept track of his "kiln turnover," and was automatically urged to investigate unusually long turnovers in order that he might reduce the burning time as well as the amount of coal consumed, and investigate unusually short turnovers with a view to making such gains permanent. This chart is of interest also, as an almost perfect illustration of the ratchet principle discussed in previous chapters.

The next two charts, Figures 65 and 66, illustrate what was accomplished, in one instance, by means of a combination of technical knowledge, the scientific method, and the centralization of control in the dispatch office as described. It should be noted that, besides the reduction in burning time, the number of heat retrogressions was also reduced very materially. Together, these two changes reduced the coal consumption 17 per cent in one case, and 38 per cent in the other.

The method of boiling down the results of such work as that described to a few figures which give the management a grasp of the whole situation, is illustrated by the chart in Figure 67. In this connection,

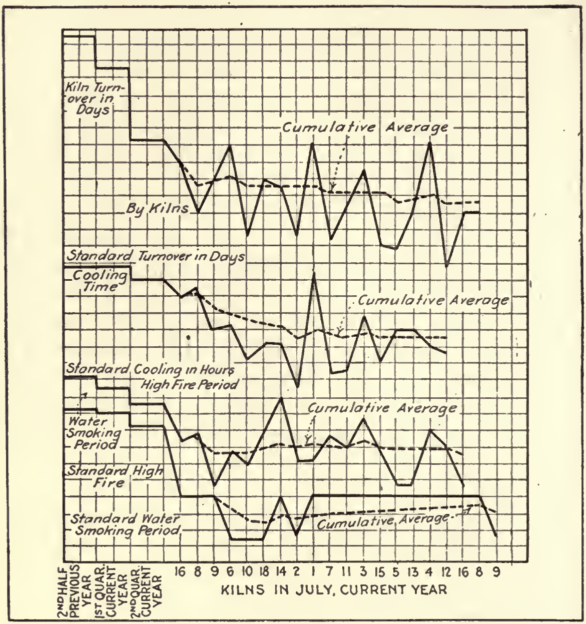


FIG. 64. KILN TURNOVER CONTROL GRAPH

An example of the practical application of the ratchet principle to a manufacturing process by graphic technical control.

chief executives should be warned against trying to carry too much statistical detail into their own offices. It is very easy to spend a lot of money keeping up a lot of charts which are used so occasionally that they might better be kept at the point of use—in the dispatch office, for instance. If an executive has too

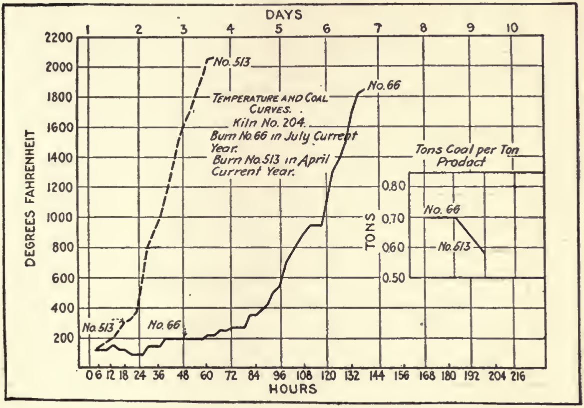


FIG. 65. RESULTS OBTAINED THROUGH APPLICATION OF SCIENTIFIC METHODS TO FURNACE OPERATIONS

many charts, he never looks at any of them. The selection of just what should be forced upon his attention, and the elimination of what he should not be bothered with, therefore become a matter for the exercise of considerable discrimination. Besides, rather than depend too much upon charts, it is much better for the executive to make a trip through the works occasionally and to take up matters of detail on the ground, where physical evidence of the question under discussion is before him.

The burning-control chart, in the first space, shows the executive what it is most vital for him to know, i.e., how nearly the department approached the realizable standard. The second, fifth, and sixth spaces

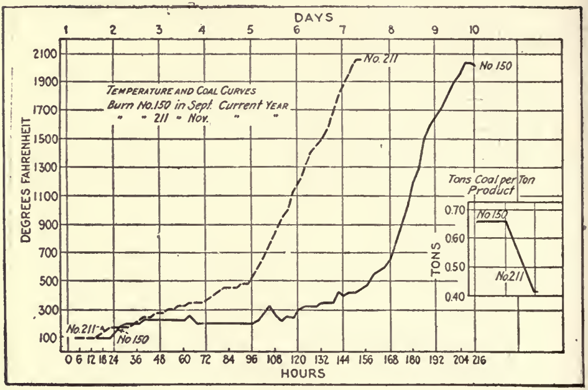


FIG. 66. THE EFFECT OF CENTRALIZED CONTROL AND SCIENTIFIC METHODS UPON A FURNACE OPERATION

show the factors that control this percentage of realizable accomplishment—quality, material, and labor. Quantity is, in this case, controlled by material (coal), since the longer the product remains in the kiln, the less product the department can process. The third and fourth spaces show the detail of the second space, and answer the question: If the quality was not what it should have been, what was responsible?

Figure 67 illustrates, also, the exception principle. If the first space indicates a 100 per cent performance, the executive need not take time to investigate further. If there is a drop in efficiency, he can locate the trouble, nine times out of ten, by reference to the other spaces. In the tenth case, he can secure the answer at the dispatch office.

Another point of interest in connection with this chart, is the drop in efficiency in February. At this time the men in the department had had a good taste of bonus in December. They conceived the idea that all they needed to do was to keep on cutting the burning time, and the coal consumption would keep on decreasing until they fairly rolled in wealth. So they cut the coal in January down to 0.41 (Section 5, Jan. 15). As a result they spoiled a lot of product by rushing it too fast (Section 2, Jan. 15). In consequence, they pulled their efficiency down to 82 per cent and lost most of their bonus. The advantage of making haste slowly thus having been brought home to them, they increased their burning time (and their coal consumption) and their bonus, until such time as they had learned how to proceed more surely. We find them—because they learned this lesson—above 100 per cent efficiency in May, with the percentage of first-quality product above standard (92 per cent), and with the coal below 0.40.

Insuring Competent Management.—It would be possible to multiply indefinitely instances that illustrate what can be accomplished by the combination of technical knowledge, scientific research, and statistical executive control. The situation in each case must be studied impartially, the scientific method must be applied fearlessly, and the machinery of control must be so organized that progress will be relentless. Under such circumstances, the knowledge becomes an asset of the company, instead of the "trade secret" of an individual. The best brains available—whether of workmen, of executives, or of outside experts—are

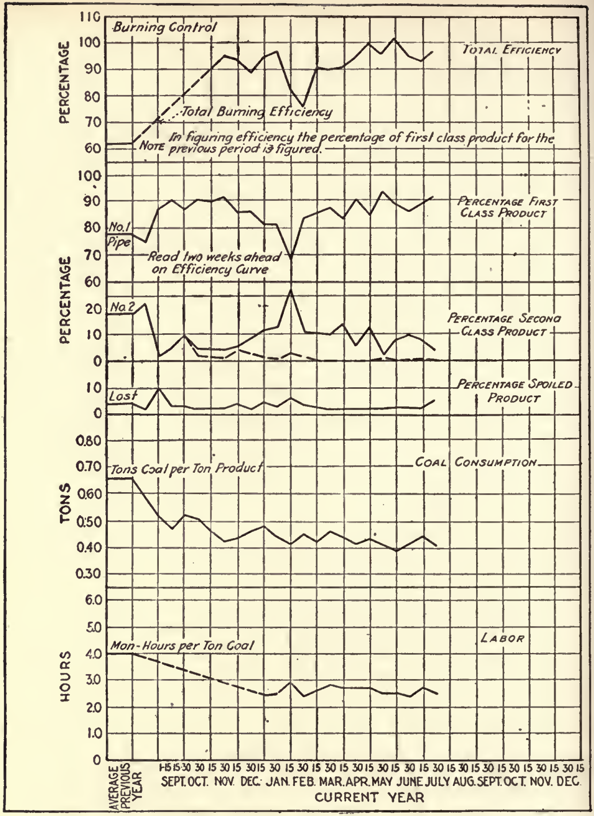


FIG. 67. CHART SHOWING THE REDUCTION OF THE ESSENTIAL FACTORS OF A TECHNICAL PROCESS TO A SINGLE CURVE

brought to bear upon the situation. Briefly, then, exact and competent management is continuously assured, since:

a. Once a best method—either of doing the work or of meeting a condition—is determined, it becomes a permanent record of the company, so that the expense of solving the problem does not have to be incurred more than once. Costly mistakes are not repeated, and the concern ceases to be the personal experimental school of new executives.

b. The capabilities of various subordinates are more exactly determined, so that the likelihood of mistaken promotions, which are costly, are reduced.

c. Trade secrets become the property of the company.

d. Faults, whether of men or of managers, are automatically traced to their source.

e. Exact and definite knowledge takes the place of bluffing; this applies to men, foremen, superintendents, and managers.

f. Unnecessary executive work is eliminated by the introduction of the exception principle, which, while it brings only abnormal conditions to the attention of the management, brings those forcibly to their attention.

CHAPTER XVII

PLANNING AND DISPATCHING CONTROL

Casual Management and Its Results.—When departmental outputs under the continuous-production system of operation are studied intensively, the effect of lack of exact and scientific planning methods becomes evident at once. Under casual management, the output flows from department to department by fits and starts. The stream is dammed up in one department until work becomes hurried and careless. The wrathful descent of the old-time superintendent upon the unlucky foremen, only adds to the confusion as he tongue-lashes such subordinates as are unlucky enough to cross his path. Workmen rush wildly about making more mistakes, material is spoiled, and men stand idle while the superintendent is berating the few who first attracted his attention. Meantime, men in the preceding departments loaf because floors and benches are piled high with work that cannot flow away from them, and men in succeeding departments loaf because no work can flow to them.

The accompanying chart, Figure 68, illustrates a typical situation of this kind. The normal production in this shop, we shall assume, should be six hundred tons. Department A, at the time we are considering was so busy performing the first operation on the raw material on Tuesday and Wednes-

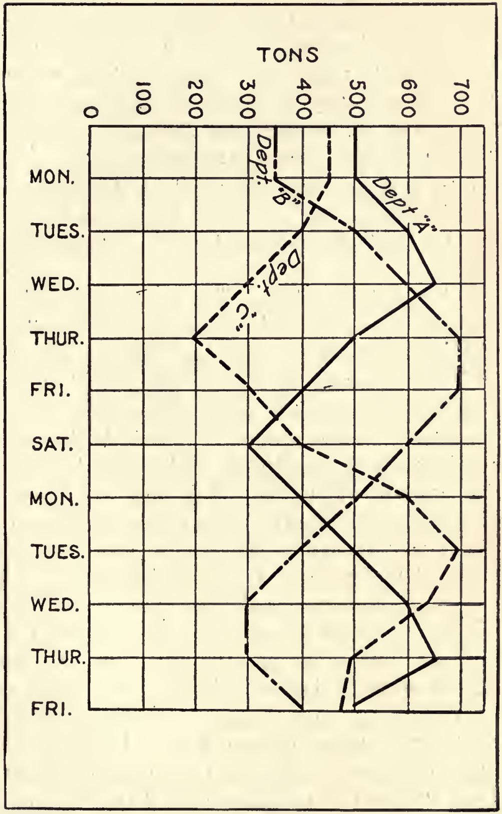


FIG. 68. DEPARTMENTAL OUTPUT CHART

day that no semi-processed stock came to Department C, which meantime experienced a "famine." The superintendent got busy in A on Thursday, and "by main strength and awkwardness" pushed enough of the stuff through the second operation performed in A so that by Friday enough of it reached C to cause C's output to increase. It continued to increase until it reached its peak on the second Tuesday. B meantime began to be starved for work, so that by Saturday its output began to fall off.

As will be observed, the flow of output under this system consists of a series of peaks and valleys indicating a progressive feast and famine alternating in each department in turn. The number of employees in each department of course remains virtually constant. Since there is a limit to the amount of speeding up a department will stand, but no limit to the amount of loafing that can be done when there is no work ready, the expense of production remains constant while the product averages lower than would be the case were the flow steady. Thus, in the case cited the output averages 486 tons for the 11 days, instead of 600 tons, while the expense is as great as if the full output were secured. With a payroll of $6000 a day, the direct labor cost per ton under the "feast and famine" system illustrated, would be $12.34, as against $10 under a system of scientific planning. Add the increased overhead cost per unit, due to low production, and the loss of profit on 114 tons a day, and the expense of casual planning at once becomes evident.

Time-Study and Job-Production Operation.—Under the job-production type of operation, analytical time-study perhaps brings out the cost of unscientific planning more quickly than anything else. The following is an extract from a report rendered in regard to the cut and punch department in a metal-working concern. The department was rated at 50 per cent efficiency.

> The causes of inefficiencies were as varied as the operations. In a number of cases, two operators were being used where one would have been sufficient. Several studies show one operator working at different efficiencies, at different times, on the same work. One of the commonest inefficiencies was that of throwing material on the floor, from which it had to be picked up, instead of piling it on a truck. Poor methods of handling material were common, as were instances of unnecessary handling. In some cases work was being done in the wrong way, raw material was lacking or was unhandily placed, gauges were not used where their use would have tripled the output, and the wrong machine was used for the work. Machines were in wrong adjustment. Machines were changed frequently for small orders, and unnecessary operations were performed. We found operators leaving their machines to do their own trucking, handling scrap in order to perform their work, and carrying parts by hand where they should have been delivered to them by truck.

There you have it—casual planning at its height! Scientific planning would have had the material delivered exactly when it was wanted. The work would have been scheduled to the machine best fitted to do it. The number of operators would have been specified. Gauges would have been provided. Trucks would have been there to take the processed metal away. Work would have been scheduled to machines

in such a way as to require the fewest possible number of changes in set-ups.

I remember watching a pressman, once, in a printing establishment clean the red ink from his rollers, cover them with blue ink, do a short job, clean his rollers again, and then use red ink once more. He wasted half an hour out of two hours for which he was paid full time. In the same shop, an elaborate set-up on a ruling machine was changed to a simple one, a small job was run off, and then the machine was changed back to another elaborate job almost identical with the first one. Planning would have saved 25 per cent of the direct-labor cost in the first case, and 50 per cent in the second case.

Scientific Planning and Dispatching.—Just how scientific planning and dispatching eliminate such faults as have been described, I can perhaps show best by citing Standard Practice Instructions issued to the Planning Department of a foundry.

A. PLANNING THE WORK:

1. *Points to be Considered*:
    - *a.* No job is ready until everything is ready for the job: consequently, the management of shop should be certain that everything in the way of patterns, flasks, special rigging, and so on, will be in readiness when the job is started.
    - *b.* No job is to be started until it has first been scheduled for some particular workman.
    - *c.* Sufficient work should be scheduled ahead so that there will be no likelihood of a man's running out of a job. It is far better—in fact, preferable—to schedule too much work rather than not enough.

2. *Time for Planning*:

   Each day, as early in the day as possible, the work for the following day should be planned by those responsible for the management of the shop.

3. *The Planning Sheet*:

   As work is selected, it should be entered on the planning sheet for the current day, which is to show for each man, gang, or floor the work scheduled, showing number wanted, order number, description of work, and the pattern number.

   Entries should be made in the same order as the work is to be made.

   A regular planning sheet is then to be written up for the following day from the information shown by the revised copy of the current day's planning sheet.

4. *Entering Standard Times*:

   When this has been done, the various items should be checked against the file of schedules, to see if any of the work listed is covered by schedules. For such work, the planning sheet is to show schedule number and the standard time allowed. For new work, or work coming in for which no schedules have been made, an estimate should be made covering such items as should, in the estimation of the shop management, be given a standard time which should be entered on planning sheet and estimates.

5. *How Issued*:

   Four copies of the planning sheet should be made, and distributed as follows:

   To the Core Room.
   To the Industrial Engineering Department.
   To the Dispatching Office.
   To the Foreman in each section.

6. *Carrying Forward Uncompleted Work*:

   Each morning the dispatcher is to take the planning sheets for the previous day and cross out

the work that has been made, as shown by the service cards. In cases where a balance remains to be made, the number wanted, as shown by the planning sheets, is to be corrected to agree with the balances on the service cards. The planning sheets for the current day should then be taken and compared with the one for the day previous. If the work that was not completed, as shown on the sheets for the day previous, does not show on the sheets for the current day, it should be transferred to them so they will furnish a complete statement of work which has been scheduled ahead for men.

The sheet for the current day, now revised, is to be used each day by those scheduling the work, as a guide in planning for the following day. In this way, all old orders will be brought forward each day and be kept before the attention of the shop foreman.

B. DISPATCHING:

1. *Writing up the Service Cards*:

As orders are received and noted, for steel castings or for iron castings to be made in the steel foundry, they are to be turned over to the dispatcher, who is to make out a service card in duplicate for each item as shown, assigning to each a "flask number," which is to be entered on both the order and the service card.

2. *The Dispatch Board*:

The dispatch board is classified as follows:

a. According to work which is unavailable, filed by classes of orders by order numbers.

b. According to work which is available, but not assigned to any particular man, men, or floor, and filed by classes of orders by order numbers.

c. According to floor or men for work assigned, each space being divided into three sections, as follows:

1. First, or top, section to hold jobs that are being worked on.
2. Second, or middle, section to hold jobs that workmen are to start on upon completion of work, or on starting in the morning.
3. Third, or bottom, section to hold an available supply of work for a particular workman.

3. *Filing Service Cards*:

As soon as service cards are written up, they are to be filed according to the proper class in the "unavailable" section, by order numbers. As the dispatcher is notified by the Pattern House that jobs are available (by means of the pattern cards sent to despatch office), the service cards corresponding to the pattern cards received are to be transferred to the "available" file.

4. *Procedure after Jobs have been Planned Ahead*:

After the planning sheets have been written up, the service cards for the new work coming in, corresponding to the items listed, are to be removed from the "available" file, and the schedule number and the standard time are to be entered, after which they are to be filed on the dispatch board against the men or floors specified.

Service cards for uncompleted orders, which will be found on the dispatch board, on account of the previous removal from the "available" file, will be rearranged according to the planning sheet. After this has been done, the dispatch board should be an exact duplicate of the planning sheet.

5. *Issuing and Closing Service Cards*:

As workmen report to the dispatch office in the morning, the service cards corresponding to the work they are to start on are to be removed from the second, or middle, section of the dispatch board, the starting time entered, the duplicates

given to the men, and the originals filed in the top section of the dispatch board for the proper men or floors. As this is being done, the top service card in the third section is to be transferred to the second, or middle, section as "the job ahead."

As workmen report, upon completion of work, the original copies of the service cards are to be removed (top section), also the service card in duplicate covering the job ahead (middle section). The original, covering the completed work, is then to have entered upon it the finishing time, the number of pieces moulded, and the date, after which the service cards for the job ahead are to follow the procedure outlined at the beginning of the paragraph immediately preceding.

Under this system, or under systems that are modifications of it, the presence of the man, the machine, the material, and the accessory equipment, is assured for the proper time. Standardization must, of course, have taken place before the time required for the work can be accurately predicted. The more complete the standardization of machine and material delivery, and the greater the assurance of the worker that he can perform the task in standard time, with suitable reward for such performance, the more accurately the work can be planned and the less necessary is any readjustment of schedule.

Planning: Continuous-Production System.—The last word in scientific planning under the continuous-production system, is exemplified in the "control boards," for scheduling work, the Franklin automo-

NOTE.—Full description of service cards, Dispatch Boards, etc. will be found in Chapter IV.

bile plant in Syracuse.* Mr. Babcock and his associates have worked out a "medium to guide the carrying on of all necessary acts in the preparation of a complex product, so there will be a minimum of confusion and a maximum conservation of capital in material in stores, and of material and labor costs in work in process." The plan is unique.

In studying these boards I found that automobiles that were to be turned out in December were on the boards in May—every part planned, and the date on which the work on each part was to be done already decided. Service cards for work weeks ahead had been prepared, and were filed ready for the operatives. I asked whether war shortages in materials were not upsetting such elaborate and detailed plans. The answer was, "To some extent, yes—but we know the scarcities months ahead, instead of a few days ahead, and plan accordingly."

Planning: Job-Production System.—The Tabor Manufacturing Company, in Philadelphia, the "cradle" of Scientific Management, is the supreme example of planning under the job-production system. Just how many of each sort of machine made must be manufactured, depends upon the demands of the trade. Standardization and planning have, however, reached such perfection in the ten or more years the shop has been operated under scientific management, that the Company has established what is called the "Library." When a machine is called for, an order to their "Librarian" brings forth from his

* See also "Planning and Time Studies," G. S. Armstrong; Vol. 3, Factory Management Course.

cases complete plans and instructions to the last detail. Such perfection cannot be attained in a day, but once it has been reached, think of the delay, the discussion, and the unnecessary expense that the owners of such a company are spared!

Wastes Due to Imperfect Planning.—Two examples of labor and equipment wastes due to imperfect planning, are shown by the accompanying photographs, Figures 69 and 70. The first shows nine teamsters and twelve mules who "planned" their own work in such a way that they were engaged in hauling the product from a plant to a storage yard across the tracks on which the freight train switched at a certain time every afternoon. The men were not on bonus, and so planned very intelligently for themselves, as it was easier to stand on the wagon than to load and unload, and their pay went on just the same. As far as profitable results to the Company went, the mules alone might better have done the planning!

The second picture, Figure 70, shows some more "planning." These men were on piece-work. It was to their advantage to work as long and as continuously as possible. Unfortunately for them—and for the Company, who had customers clamoring for the plant's output—the crew's next job had not been planned. As a result, the seven men when photographed—were discussing whether they should go home, or hunt up the foreman and see whether he had something else for them to do.

Bringing the Facts Before the Executive.—I believe that I have given a sufficient account of casual

FIG. 69. AN EXAMPLE OF CASUAL PLANNING

FIG. 70. AN EXAMPLE OF CASUAL DISPATCHING

planning to show what it costs a company, and a full enough outline of the methods of scientific planning to illustrate its value and the necessity for the successful executive to keep informed continually concerning the degree of perfection attained. The exact method of bringing the facts before the executive must, of course, vary with the nature of the business, the control of which is being studied. The perfection with which the planning is being done may perhaps be judged by the executive as well from its effect upon certain phases of the business as in any other way. For instance, there should be little doubt in the mind of the exectuive that idle machines cost the company money.

The following series of three charts, Figures 71, 72, and 73, illustrates what is meant. To take a simple case, let us assume that the first cost of a certain machine is $10,000. The interest on such a machine amounts to $40 per month at 5 per cent. We have also the monthly cost of the floor space occupied in a building which has been rented, or which has been erected on borrowed capital, or whose erection has tied up capital that might have earned 5 per cent if it had been invested in bonds or mortgages. Power, heat, and light equipment has necessarily been purchased, which is not used if the machine is idle, but interest on it must be paid, nevertheless, whether the machine is run or not.

The machine, the building, and the power plant must be insured. Depreciation must be written off. A lot of foremen, superintendents, managers, clerks, and others must be paid. If the machine had been

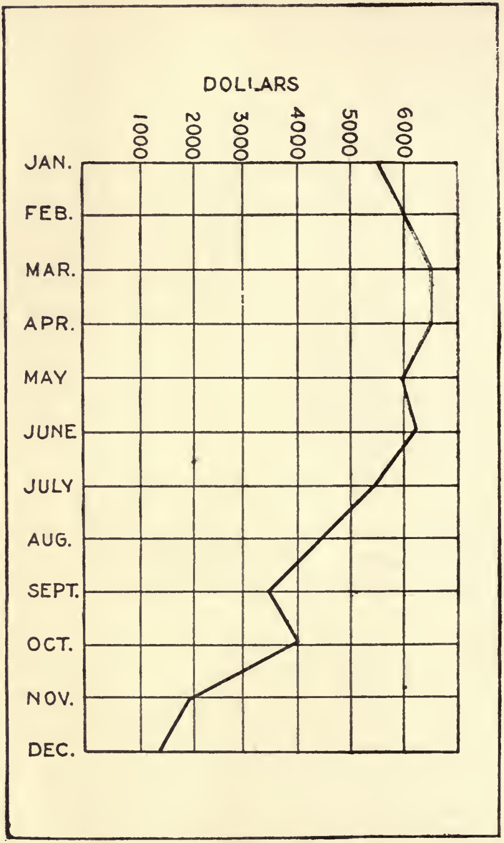


FIG. 71. IDLE MACHINE COST CHART

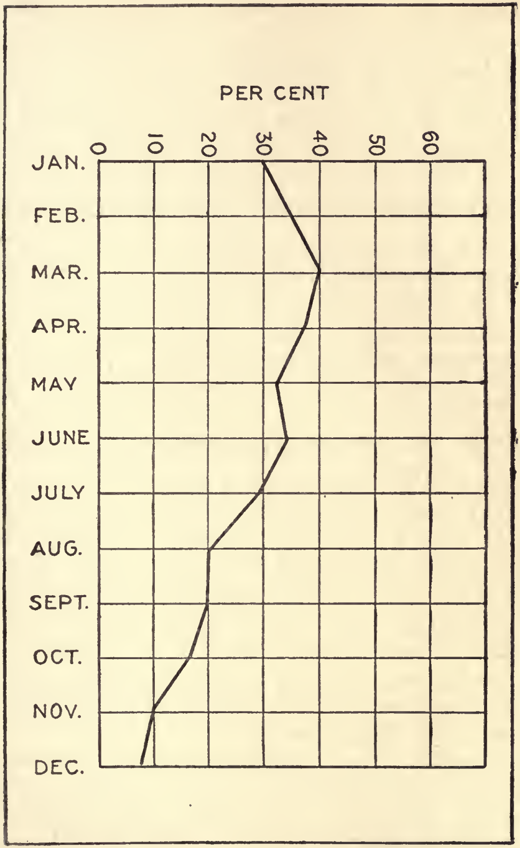


FIG. 72. PERCENTAGE OF MACHINES IDLE—DEPARTMENT D

run, the total of their salaries would have been divided by the increased output. It is only fair, therefore, that the machine should bear its share of such expense when idle as well as when busy. Furthermore, the machine would not have been purchased if the company had not expected to make a certain profit on the goods it was expected to turn out. Suppose we estimate the cost of these items as follows:

Interest—30 days @ 5% on $10,000	$ 40
Rent of Floor Space in Building, etc.	25
Power, Heat, & Light, paid for, but not productively utilized	10
Insurance, Depreciation, etc.	5
Supervision—paid for, but not used	25
Profit on goods which machine was purchased to manufacture	500
Cost per month to maintain idle machine	$605

Figure 71 illustrates what a group of such idle machines is costing the company each month, and shows this in such a way that the executive cannot fail to realize the seriousness of the situation. The expenditure of the five or six thousand dollars shown on the "Idle-Machine Cost" chart might just as well be labeled "Money Thrown Away." At any rate, the continual perusal of such a chart cannot but spur the management and the organization to some sort of exertion in the right direction.

How effective this exertion will prove, will depend upon the thoroughness with which the causes of idleness are analyzed. The second chart, Figure 72, shows the proportion of idle machines in Department D, which we will assume the executive has found to

be the chief offender, from his perusal of the chart apportioning the expense shown in the first chart.

Department D's performances having been noted, the executive turns to the third chart, Figure 73, which analyzes the causes of these fluctuations. It appears that in the early months of the year the shutdowns were caused about equally by material (shortages, and so on), equipment (breakdowns, and lack of dies, jigs, fixtures, tools, and the like), and orders (not received from the sales department).

Further study of "equipment delays," carried on by means of "machine delay" charts, such as were described in a previous chapter, and study of "material delays," gradually reduces the percentage of such delays from July on, as shown by the chart. The percentage of delays due to lack of orders necessarily increases, and puts the problem squarely up to the sales department and those responsible for the policy of the company. Quite naturally the second chart reflects in August a reduction of the percentage of machines idle, and the cost of idle machines (see Figure 71)) also decreases. The reduction of material and equipment delays means, principally, that planning has been done more effectively than before.

Business Value of Dependableness.—Another phase of the business which reflects the effectiveness of the planning department, is shown by the next series of charts, Figures 74 and 75. Several years ago, a plant manufacturing bolts, nuts, and a variety of steel parts, called in specialists from a firm of efficiency engineers to instal methods of control. After a number

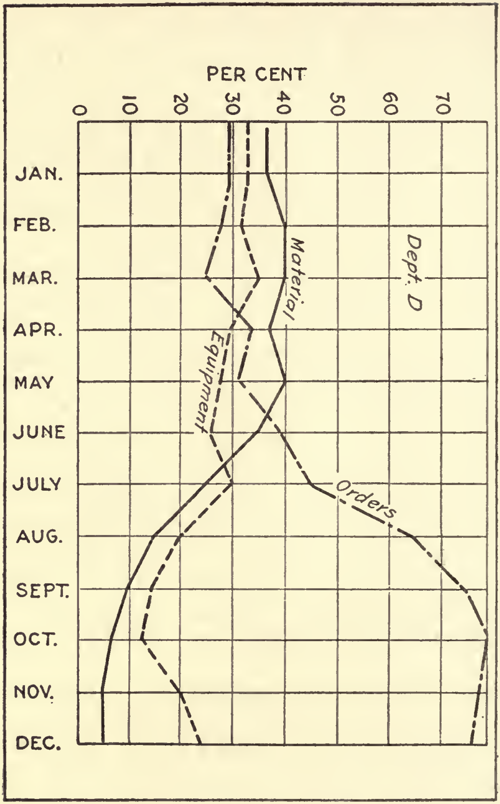


FIG. 73. CHART ANALYZING CAUSES OF DELAY—DEPARTMENT D

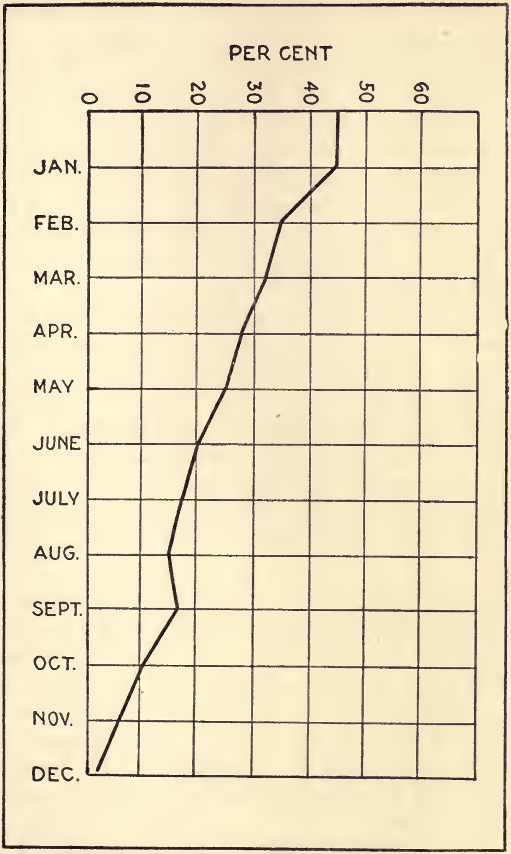


FIG. 74. PERCENTAGE OF PRODUCT DELAYED BEYOND DATE PROMISED

of months, "preliminary planning" was started. The orders on hand were scheduled to departments and to machines in a rough sort of way, in order to get the work started. It was at once discovered that the sales department had been planning deliveries that were absolutely impossible. Smith, the sales manager, when taken to task by one of the engineers, said, "You must understand, my dear young man, that competition is so keen in this line that the only way we can get business is to promise quicker deliveries than our rivals."

The engineer made no reply, but later in the day he asked the general manager whether the company had deliberately adopted the policy of attempting to hold its customers by telling them lies and disappointing them on deliveries. The inevitable explosion occurred, but when the smoke had cleared away the sales manager was instructed to promise no deliveries unless the date were set by the production engineer, who had charge of the planning department.

Six months later, the purchasing agent of one of the largest agricultural-implement companies in the world called the production engineer on the phone. "Smith tells me your company has got a new system. He's the biggest liar in the country, and the last time I gave him an order I swore I'd never give him another one; but I'm up against it for bolts, and I'll give you a trial if you say you can get them out in three weeks."

The production engineer refused three-weeks' delivery but promised thirty days. The bolts were

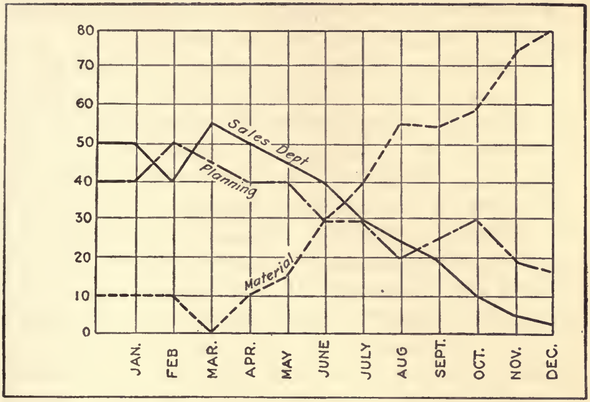


FIG. 75. DELAYED DELIVERY ANALYSIS CHART SHOWING CAUSES OF DELAYS. SEE CHAPTER XV

shipped on the twenty-third day. That agricultural-implement company has been one of the firm's best customers ever since!

Such an episode as that brings home the old adage that honesty is the best policy—even when selling goods. The executive who can clinch his customers to him by means of a reputation for so conducting his business that his factory always does better than his sales department promises it will do, need not worry about the certainty of his market. If he wants to know who is responsible for customers lost by lies, a chart designed along the lines suggested by the accompanying illustration, Figure 74, will tell him. The unfortunate feature about this chart is its "lack of permanency"—as the man said about the horse he

had educated to live on sawdust. About the time the chart is working nicely, it eliminates itself.

The first chart, Figure 74, shows the percentage of the product delayed beyond the date of shipment promised—in other words, the percentage of customers lied to, consciously or unconsciously. The second chart, Figure 75, shows who told the lies. It will be noted that the sales department had the riot act read to them early in February, so that they became more conservative in their statements. The drop in the percentage of customers lied to is immediately noticeable on the first chart. In March, the lies attributable to the sales department increased, in spite of the fact that they were making an honest effort to tell the truth. Evidently the information coming from the planning department, which was just getting started, wasn't reliable.

By May, both the sales and the planning department were "hanging it on" the material-order department. Meantime the proportion of deceived customers had dropped from 45 to 25 per cent. Comparatively, the company was becoming quite truthful. By November, the sales and the production department had definitely "passed the buck" to the purchasing department. Their skirts were clear. Incidentally the purchasing department had increased its batting average and the customers—all except 5 per cent of them—believed the sales manager when he swore he spoke the truth. By December, the deceived ones were almost eliminated, and so is the chart, whose usefulness departs as soon as the sales manager realizes that the factory means what it says

when it promises him a delivery, and that his reward, once the customer realizes that the company keeps its word, to the letter, is praise and friendship instead of abuse and suspicion.

Scientific Planning Pays.—Scientific Planning is worth while. Like everything else in our large corporations, it needs the intelligent and continuous push of the wise executive behind it. Statistics and charts that keep the chief executive constantly informed as to the efficiency with which the planning is carried out, and as to its effect upon the net profits, should not be considered a burden upon the business.

CHAPTER XVIII

PRODUCTION AND SALES CONTROL

Executive Must Promote Harmony.—Unless the executive understands certain fundamental differences in the temperament and training of the men who compose a company's sales and operating departments, no amount of system will promote that harmony of action which is necessary to insure a smoothly-running and successful organization.

No matter how agreeable the general sales manager and the general superintendent are to each other socially, no matter how high the quality of the personnel of each department, no matter how capable and carefully organized the commanding executive force, there are always present latent suspicion and antagonism, which, unless they are understood and controlled, continually take their pound of flesh from the net profits. The fundamental cause of this antagonism lies in the temperamental difference between the type which succeeds as salesman and the type which succeeds as superintendent.

Salesman and Superintendent Contrasted.—The good salesman is an optimist. In order to make others believe in his goods, he must believe in them, himself, regardless of their real quality and worth—even when their quality wouldn't deceive a blind man at midnight. He must be an enthusiast, no matter

how black the business outlook, or his sales volume will be negligible. And he must have a personality force almost equivalent to hypnotism. Therefore, as a result of the salesman's continued and necessary effort to deceive himself—or at least to select the most favorable aspects of any situation, and then to persuade himself that these are all true—it becomes very easy for him to believe what he wants to, or what the exigencies of the situation demand that he believe. This continual distortion of his point of view cannot but leave a permanent impression upon his mind, and in time it becomes difficult for him to form complete judgments and to reach entirely unbiased decisions. There is a tendency, also for the salesman to exaggerate. As one man expressed it, "When two black cats are howling on the back fence, the successful salesman must be able to think the back yard is full of black cats." The Hamlet type—the man who sees all of both sides of the question and then loses himself speculating about both, who hesitates rather than acts, is no salesman. The man of judicial temperament, who weighs both sides with exceeding accuracy, instead of immediately coming out strongly for his own side, believing "There may be something in the other fellow's side, but that's his business, not mine"—such a man is not likely to prosper as a promoter. Belief in himself, belief in the goods he is selling, the firm conviction that he is doing all mankind a service in allowing them to purchase, and the ability to tell people about his proposition in interesting fashion, these are the requisites of a good salesman.

The successful superintendent or factory manager is almost the exact opposite of the successful salesman. He must be able to analyze conditions in such a fashion that he will secure all the facts. He must be able to spread these facts out upon the table before him, as it were, determine their exact relative importance, discard all irrelevant matter, and then, overlooking nothing, make his decision. He must reach his conclusion after an accurate and exhaustive examination. The salesman, on the other hand, is furnished his conclusion at the beginning. He is told, "The goods are O.K. Go out and sell 'em." Thereupon he must build up and arrange his facts to prove this conclusion.

The superintendent deals with things tangible: materials, machines, the productivity of the man-hour. To him the personal equation is only one factor in a dozen. To the salesman the personal equation is everything. The factory manager can plan his work a long way ahead. The salesman knows not at what time a poorly digested dinner may upset his best laid plan of campaign. The factory manager regards himself as prudent and far-sighted, and the salesman looks as a creature of the moment —a person of whims, unstable as the summer breeze. Why should the salesman plan elaborately? As one man remarked, "I can work out my opening sentence before I go to call on a man—but what my second sentence will be is beyond the forecast of anybody I know of in the prophet business for the last 1900 years." Detailed plans would only be an encumbrance. He can lay out beforehand the general line of

thought he wishes to develop; but just what he shall do and say, he must determine as the situation develops.

The judicial temperament is an asset to the factory manager. He must be able to weigh both sides of any question, for he must treat his men fairly. Very often, he must even protect them against doing themselves injustice. He must be enough of a pessimist to foresee possible dangers and to guard against them. Like the salesman, he must have a personality force—but since most of his viewpoints differ radically from those of the salesman, this force makes for antagonism rather than for harmony between these two types of men.

The man at the head of an operating organization must always state his case exactly, concisely, and briefly, in order that there may be no danger of a misunderstanding. The superintendent, then, is likely to regard the salesman—who makes statements based upon a single premise, and who exaggerates facts—as something closely akin to a liar. He is likely to consider the salesman's volubility with much the same feeling of silent contempt with which a sage might regard a chattering popinjay. If he envies his rival's facility of expression, his silence and contempt are only likely to be the more marked. The superintendent has made his way up with flannel shirt and dinner bucket, and naturally takes a certain pride in roughness and masculinity. He is therefore likely to regard with a mixture of awe and contempt the man in the silk shirt—whom he perhaps regards somewhat as a pampered patron of the lobster palace and of the peroxide manicurist.

I may have drawn the contrast a trifle strong, but it is nevertheless true that both the early and the later environment of the two types differs widely in most cases. The characteristics which make for success in the production department, differ widely from those that bring a man to the top in the sales department. Consequently there are temperamental differences in the two types of men which are continually cropping out. This is simply a fact to be faced, and the best general managers provide accordingly.

Friction between Sales and Operating Departments.—Friction between the sales and operating departments is almost incalculably harmful. By way of illustration, let us take what is perhaps the commonest inefficiency; namely, the interruption of production by rush orders. In the factory, the work for the period—a month, or a week, or whatever it may be—is planned in advance, and the material is then ordered. A consistent adherence to this plan is essential to economical operation. In the middle of the period, the sales department sends in a rush order. Some customer has been caught short, or a new customer can be obtained by the promise of early deliveries. The factory's plan is completely upset, departments are thrown out of balance, overtime lowers the efficiency of the operating force. The superintendent is furious, knowing, as he does, that he will be held accountable for the cost per unit which must inevitably increase.

Let us take another instance. The sales manager promises a certain delivery—perhaps without conferring with the superintendent. Or it may be that

the superintendent, somewhat in awe of his more brilliant associate, is carried off his feet by arguments, and promises an earlier delivery than his best judgment approves. The factory falls down on delivery. The customer is enraged, and the sales manager is frantic.

In either case, mutual condemnation and ill feeling are the result. Both departments fall in efficiency. Factory costs increase, the sales department's hold upon its customers is weakened, and the net profits suffer.

Three Types of Business.—The remedies for such conditions differ somewhat with the nature of the business. In general, business may be roughly classified under three divisions:

1. Monopolistic—in which the corporation occupies a position that is almost unassailable as far as competition is concerned—as when it possesses a patent, a corner on a raw material, or a franchise. The attitude of the sales department in this instance might be described as aristocratic.

2. Strategic—in which the corporation has a less strong, but still a definite, advantage over its competitors—such as being the first in a given field, well-established enough, or large enough, to dominate the situation. Or, a company may be better organized than its competitors and, through lower costs or better quality, have a surer hold upon the public. The attitude of the sales department in this case may be characterized as self-respecting.

3. Competitive. The distinction between this class and class 2 is somewhat more difficult to describe.

The competitive class includes concerns which have no distinct advantage over their competitors, but which depend for their sales upon public favor, political pull, the cutting of prices, the creation of a clientele, and so on. Department stores, with their absurd service features, fall into this class, county, state and city governments, and manufacturers selling to public corporations, besides all sorts of minor concerns dwindling off down to the corner grocery or drug store, which must hold business against its rival across the way. The attitude of the selling force in such a business may be described as subservient.

Monopolistic Type.—In the case of the first type of business, the sales manager is a distributor rather than a salesman. The demand for the goods is greater than the supply, and the sales manager decides who shall be favored. Salesmanship is a thing unknown and unnecessary. In one such concern which I once knew well, the general sales manager was popularly known throughout the field as the general excuse agent of the company. He didn't have to sell goods; his job was to calm down clamoring customers, to explain to them why their orders hadn't been filled, and to feed them any sort of soothing syrup that would stifle their cries. At one time the pressure had become so great that the sales manager, driven nearly frantic, was promising any delivery demanded, no matter how ridiculous. Customers were of course disappointed when the goods arrived way behind schedule, since in many cases it meant heavy loss to them. The firm got the reputation of not liv-

ing up to its promises. As a result, the next time a customer placed an order with the firm, he endeavored to protect himself by demandinig delivery in even shorter time—hoping that a promise for thirty-day delivery would bring him the sixty-day shipment he needed. When this plan became universal among customers, and their follow-up systems were in full operation, beginning with the soft pedal at thirty days and ending in a perfect bellow of rage and abuse about the sixtieth day, the life of the general excuse agent was one of anguish and misery.

The only vent for his wrath was the factory, "which hadn't turned out the goods, which was responsible for his breaking his promise, which was giving the company a bad reputation," and so on. Customers began to phone and write the factory direct, "We don't want to talk to the sales manager —wouldn't believe him on a stack of Bibles as high as Pike's Peak; what we want to know is, when we are going to get the goods!"

The factory manager finally got tired of this sort of thing, and called a conference of the executive heads of the company. At this conference it was decided, first, that no rush orders were to be accepted without consultation with the factory; secondly, that the decision as to date of delivery should rest with the factory; and thirdly, that ten per cent should in every case be added by the sales department to the delivery time set by the factory—and that no amount of argument, exhortation, or threatening on the part of the customer should be allowed to force the sales department to concede even one day on such delivery.

This may seem rather drastic action, but the results justified the means. Within three months the harried look had left the sales manager's face. He had to have his fight only once—at the beginning, when the delivery date was settled. When the goods reached the customer from seven to ten days before they were promised, their compliments were from the heart. Within six months, the attitude toward that company of people throughout the entire district, had changed. Customers believed what they were told. They had confidence in the company, the sales manager had leisure to consider pushing other lines, and overtime congestion and inefficiency at the factory became a thing of the past.

Strategic Type.—It would not be possible to adopt quite this plan of procedure in the second type of business. If you tell a customer flatly, even if tactfully, that he can't have the goods until such and such a date—long in advance in many cases—he will forego his preference and buy from your competitor. For that reason it is out of the question to act always according to the arbitrary law that places the decision concerning the date in the hands of the production department. The individual case must be carefully considered.

The policy adopted by a certain large concern that controls some twenty factories, each with its own selling force, meets the situation admirably. It had been the custom for the sales manager in one of these factories—a plant employing about two thousand men—to rush into the office of the production manager with orders to turn out a certain number of say

"X 34 industrial locomotives" by such and such a date. The production manager would protest that these orders would interfere with the other work, but he would be overawed by the stronger personality of the sales manager, who was well equipped to prove his points, and who was inclined to regard the factory as chronically overloaded and protesting anyway. Consequently, schedules were upset and the inefficiencies usual under such circumstances resulted in both departments. Naturally conditions became worse and worse, until finally this rule was laid down: "No production orders shall be accepted by the Factory unless signed by the General Manager."

What happened as a result of the order was this: Whenever the sales department secured an order demanding early delivery, the sales manager went to the production manager, not to bluff and browbeat him, but to find out what the factory could do. The planning sheet was brought out, and in frank conference the two men decided what was the exact relative importance of the new order to the orders already scheduled. If the new order was more important, it was given precedence over some old order. That was the only decision allowed the sales manager—and it was a decision well within his province since he, of all men in the organization, was most closely in touch with his customers and their needs, and knew best the danger of losing them. This point decided, the production order was then sent through the usual channels, the credit was O.K.'d, and so on, and the order came to the general manager for his signature. Then—and not till then—it became an

order to the factory. This plan made the general manager a court of last resort and insured for both sides a fair and complete hearing in case of dispute. It also brought the sales and production departments together on a basis which had never existed before. Mutual respect, born of a mutual understanding of each other's problems and difficulties, frankly discussed, made possible many economies in the factory and changes in the product that made selling easier.

Competitive Type.—In the third type of business the sales department is supreme. Owing to severe competition, the customer must always be placated by earlier deliveries, better service, or some other special favor. The factory must bow to the will of the sales department, and if inefficiencies result in high costs of production the business is doomed. The fault lies with the original investor, and cannot be remedied by the existing executive force.

Establishing Close Relationship between Departments.—The value of a close relationship between the members of the sales and the manufacturing force is coming to be more and more clearly realized in our large corporations. The problem is a difficult one on account of the differences in the training and the mental attitude of the respective personnels. The first requisite for a proper mutual understanding, is to place the two departments upon a basis where they will have an equal right and opportunity to be heard. Then, each department should be educated in the other's problems. Both should be encouraged to make suggestions as to changes in either department

which will assist the other. And lastly, the power of final decision should be placed where it belongs—in the hands of a just general manager who recognizes the temperamental differences in the two types of personnel. Increased efficiency in both departments, as well as an increase in the net profits will certainly be brought about if this line of procedure is followed.

Inspection Department a Point of Contact.—Another point of contact between the sales and operating departments and the customer lies in what is generally known as the inspection department; the location of this department is immaterial. The psychology of inspection never varies. Most inspectors believe that since they are hired to inspect the goods for the benefit of the customer, their efficiency should be measured by the amount of goods they reject. They think that the more defects they can pounce upon, the more likely they are to have their salaries raised.

When I was in Detroit it was the general working rule, among the manufacturers of automobile parts, that goods were never to be shipped to the car manufacturers until scouts brought in the word that the customer's production was being delayed for lack of parts. Then a truckload of them was sent. When these parts reached the customer, he was so anxious for them that he had them put into the machine so fast that the inspectors didn't have time to think about boosting their salaries. Customers allowed parts sent at other times to lie around and rust, or to become marred, and had them so often inspected and reinspected that rejections often amounted to 40 and 50 per cent of the number shipped.

Almost any one who has worked with inspectors to any extent, has tried the experiment of having some stuff previously rejected run through and has seen it passed with favorable comment. Unfortunately, the only satisfaction obtainable is the sardonic grin or the stifled guffaw. You can't tell a man who has it in his power to make you suffer heavily, what an idiot he is. As superintendent of a plant, I once had a terrible time with a government inspector who had a microscopic eye and a heart of flint. He seemed never to tire of detailed inspection. Finally the weather came to my rescue. The temperature in the yard where he was working dropped to four degrees below zero. We put an extra stove in the shanty and delegated a boy, under threat of dismemberment, to keep it red hot. Needless to say, the inspector hugged the stove—our percentage of rejections dropped 50 per cent.

This is not as it should be. The manufacturer should not be at the mercy of the whim, the temperament, or the indigestion of some half-educated man of small calibre who delights to exert his authority.

The sales and operating departments are generally not too friendly, for reasons that I have already stated. And unfortunately, to make matters worse, the sales department too often takes the part of the customer against the factory. Add to these causes the feeling of friendship between customer and salesman, engendered by dinners and entertainment enjoyed together, and the salesman's fear of losing a customer, and it is easy to understand why the inspector's judgment is likely to cloud that of the

salesman. Defects can always be found in material, and if the salesman takes the customer's side in arguments concerning rejections, it is often all too easy to persuade the general manager that his slogan of "Quality First" is being disregarded by a careless factory superintendent. At any rate, under casual management when rejections are heavy the superintendent is usually presumed to be guilty until he is able to prove his innocence.

The Ultimate Remedy.—After all the ultimate remedy rests with such impartial organizations as the Society for Testing Materials, where engineers of broad knowledge and unimpeachable integrity devise specifications which establish standards of quality that are reasonable and fair to both manufacturer and customer. It is only to be regretted that as yet only a comparatively narrow field is covered. In the meantime, however, certain well-known firms of engineers will send out trained inspectors who are capable of viewing a situation impartially, and who will pass upon a product strictly from the standpoint of the use to be made of it and the strains that it will have to endure.

Manufacturers who are not in a position to take advantage of such help as this, will find a remedy in the "committee system." The executive should appoint a board made up of his most broad-minded salesmen—instructed to represent the customer's viewpoint—and of his most intelligent factory executives—instructed to fight for the acceptance of every sort of defective product whose defects cannot be avoided. Then, if the executive himself will preside

impartially, he will secure a set of specifications that will be of great value to the firm if they are enforced to the letter, with the whole weight of the organization behind them. Such a board, if properly handled, will work out details in such a way that the company can adopt for its motto:

> IT IS THE DUTY OF EVERY SALESMAN TO SECURE THE ACCEPTANCE OF ALL MATERIAL THAT CAN BE USED WITHOUT DAMAGING THE ULTIMATE REPUTATION OF THE FIRM.

The practice of this principle will secure the acceptance of nearly all the goods that should be accepted, and will reduce "temperamental" rejections to a minimum. The reason is, that once rigid and detailed specifications have been adopted in a conference between the operating and the sales department, the factory knows exactly what it must produce, and the sales department knows exactly what the customer should accept and what the salesmen are expected to educate the customer to accept. Under such circumstances, it is comparatively easy for the general manager to keep himself informed as to what proportion of "within specification" articles are being rejected, and to find out which customers are rejecting them. Such information indicates at once where an educational campaign is necessary.

When a man is of sufficient calibre to become general manager of one of our large corporations, he is usually a man of sufficient breadth to understand the damage his company will suffer if it has the reputation of having unfair inspectors and of making an

excessive number of rejections. Such companies pay for a bad reputation many times over, since, in time, when the firms' practices become generally known, bidders add to their bid price the cost of unfair inspection. If the chief executive of the manufacturing concern therefore can get the facts before the chief of the rejecting company, in most cases he may be sure of fair treatment.

Tabulating Rejections.—The first step, of course, is to tabulate the rejections. Take, for instance, the case of a company manufacturing automobile-body parts. Rejections were tabulated every week as follows:

	First Week in November		First Week in February	
Rough stock	15.70	per cent	1.40	per cent
Scratched on Load	8.30	"	5.20	"
Punched Wrong	1.30	"	.90	"
Flat Enamel	4.10	"	2.70	"
Crooked Thread	....		....	
Metal Scratched	.80	"	2.60	"
Scratched in Oven	4.40	"	4.30	"
Dirty	23.30	"	25.60	"
Soft	....		4.10	"
Split in Pocket	....		.05	"
Silky	....		.05	"
Spot Weld Poor	....		.30	"
Over-Baked	7.40	"	23.00	"
Runs	30.40	"	28.60	"
Dents	3.80	"	1.20	"
Miscellaneous	.50	"	....	
Total	100	"	100	"
Proportion of Shipments Rejected	20	"	13	"

The first result of such a tabulation was naturally to direct the attention of the management to the manufacturing departments responsible for the rejections, and to the firms who had furnished defective material. The first step toward improvement was to divide the reasonable rejections from the unreasonable rejections, according to customers. A little later the vice-president of the manufacturing company invited the general manager of the purchasing company to a luncheon, at which they conferred concerning future co-operation. The last step was the reorganization of the buying company's inspection department.

Qualifications of the Manager.—Personality is a valuable asset in business. But when personality merges into temperament—whether in grand opera, politics, salesmanship, or in the inspection of goods—a manager becomes a necessity. Such a manager must possess the judicial temperament—must be capable of rendering firm and impartial decisions, and, in order to retain his poise in the presence of the hysterics of the diva, before the fiery oratory of the demagogue, or under the hypnotic spell of the sales manager, he must have the facts in such form that when they are produced the case is closed. Unless he can marshal his facts in this way, decision will be based upon opinion, and casual management will prevail.

CHAPTER XIX

SALES CONTROL

Executive Should Know Both Operating and Sales Branches.—The paths of the men who have risen from the ranks to the command of our great corporations, necessarily have led either through the operating or through the sales department. Upon arrival at the point at which the two professions merge —for factory management, as well as salesmanship, has become a profession during the last ten years—the newly installed chief has many dark hours. He has specialized in one branch of the business. The other is unknown territory—and our imaginations tend to people such regions with strange and terrible monsters, as the ancients pictured the unexplored countries beyond their own.

I have already taken the executive through the operating departments, and have attempted to point out the facts which should be in his possession. I could not take him through the sales department in a similar way without the aid of another five preceding volumes. There are, however, a few fundamentals that can be covered in a chapter, and a knowledge of these may serve to lighten some portion of a dark hour for the executive who has entered into his kingdom after a long, hard climb upon the

path which leads upward through the factory to the general managership.

The Salesman Type.—First, then, there are two distinct types of men in every well-developed sales organization. There is the salesman type and the sales manager type. A cynic recently described to me the individuals of these two classes as "the men who pad expense accounts and the men who rip the padding out of expense accounts." The phrase illustrates a fundamental difference in the two types of mind. The salesman is the promoter. He is temperamental. He won't be bothered with detail. He refuses to be what he considers cheese-paring and miserly, and to scrimp his expenses. His life is a hard one—at best spent on sleeping cars and in noisy hotels, and at worst on accommodation trains and in unspeakable country taverns. Such luxuries as he may enjoy he regards as his by right, necessities if he is to preserve that self-respect, confidence, and enthusiasm which enable him to approach the prospective buyer successfully.

The Sales Manager Type.—The sales manager, on the other hand, must combine an infinite capacity for detail with that breadth of understanding which will enable him to control, assist, and inspire the artists who compose his staff. He must be able to plan a sales campaign—a task that involves the collection, consideration, and correlation of innumerable facts. He must know how to bring softly to earth again the salesman whose good fortune or whose ingenuity has resulted in a volume of sales that has sent him soaring off among the clouds with head so inflated that

he is in danger of becoming useless to the company and to himself. He must breathe courage and optimism into the man whom hard luck has driven to the verge of despair. He must know when to cut his advertising expense to a bare pittance, and when to spend money like water. He must be able to take the viewpoint of the customer, of the salesman, and of the stockholder. Incidentally this type, as may be imagined, is not very common. The sales manager usually commands a high salary—and he earns it.

Importance of Tabulating Data.—The newly promoted general manager, whose view of the sales department has been acquired from the standpoint of the factory, will do well to make haste slowly in introducing innovations into the sales department. In the first place, he is dealing with a class of men entirely different from that which he has had to control before. In the second place, he is coming from a life in which things—machines and materials—played a large part, into a realm where the chief problem is the handling of men. In the solution of this problem a knowledge of applied psychology is the prime requisite.

His safest move—and the one which will produce for his company and for himself the greatest results in the end—is to insist tactfully upon the continual tabulation of facts. The sales department exists for just three ends, or objects:

1. To sell the largest possible quantity of goods.
2. To sell these goods at the highest possible price.
3. To sell these goods with the least possible outlay of money.

These three things—Quantity, Price, and Sales Expense—determine the dividends of the stockholder, as well as the fate of the business, of the executive, and of the laboring man. And the tabulation of data—a process which keeps vital facts concerning price, sales expense, and quantity continually before the chief executive—is no more a burden upon the business than an efficient cost system.

Knowing the "Bread" from the "Cake."—In addition, an exact knowledge of which lines of goods are the most profitable, and just how much more profitable such classes are than certain others, enables the management to advise the sales organization what to push, and what to sell only when necessary. Most lines consist of "bread" and "cake"—the piece goods and the notions, in the jobbing business; the staples such as flour and sugar, and the specialties such as fancy canned goods, in the grocery business. The one class supports the business with a bare margin of profit, and the other buys automobiles for the grocer—if he can dispose of sufficient cake to customers who come to buy bread. The successful manager must know which of his goods are the "bread" and which are the "cake"—and which cake has the thickest frosting and the most plums.

Statistics Concerning Territories.—The general manager should have in his possession statistics which will show him immediately which portions of his sales territory are most profitable to work. It is important that he know where each class of goods will give the greatest margin of profit after transportation charges, sales expense, and cost of produc-

tion have been subtracted from the net sales price. The cost of selling the same product in adjacent states varies sometimes as much as 50 per cent. One state I have in mind consists of small towns situated close together. The salesman who works that state

IMPERIAL MFG. CO.

SALES EFFICIENCY RECORD FOR MONTH OF March 1916

PLACE	TO DATE	NAME OF SALESMAN	PRICE	QUANTITY	QUALITY	ECONOMY	TOTAL EFFIC.
1	80%	M. P. Long	90%	95%	88%	90%	91%
2	81%	E. L. White	92%	93%	85%	84%	88%
3	75%	J. E. Ives	93%	81%	82%	81%	86%
4	74%	P. J. Carney	90%	90%	80%	79%	84%
5	73%	R. D. Franklin	91%	80%	76%	80%	82%
6	70%	Ed. Maxwell	85%	80%	70%	70%	76%
7							
8							
9							
10							
28							
29							
30							
31							

FIG. 76. THE "SCORE BOARD" SHOWING THE EFFICIENCY OF EACH SALESMAN IN TERMS OF THE EFFECT HIS ACTS HAVE UPON THE DIVIDENDS OF THE COMPANY. SEE ALSO 78, 79 AND 82.

spends little for railroad fare, and the bill for his evening's entertainment includes only the cost of his own and his customer's ticket to the movies and a charge of twenty cents for "raspberry sody." In the next state, the cities are large and far apart. Salesmen's expense accounts include charges for Pullman

tickets, dinners at expensive hotels, and theatre tickets at metropolitan prices. If the current facts in regard to the expense of making sales in each territory are known to the general manager, when occasion arises for any choice as to which territory to push, the company's policy decides itself.

Sales Lost.—One executive I know has taken for his motto: "Sales lost are more important than sales made." Through this slogan he delicately conveys to his sales force the thought that they can do more for their company if they will analyze their failures honestly, and learn how to avoid the same mistakes in the future, than they can by talking about what big sales they have made, thinking how smart they are, and complaining how little the firm appreciates them. In order to force his men to analyze their failures, this manager has divided into five or six stages the sales steps that are necessary in the selling of his particular product. Whenever a salesman loses a sale, he is required to check the exact point at which he failed and to send the record to the manager.

"Double-Star" Sales.—Other statistics that are gathered very carefully, have to do with what he calls his "double-star sales." If a salesman can close a sale, without the fact that material will be required by the customer getting into a trade journal, he is credited with a "double-starred order," and the fact is posted on a bulletin. It can easily be imagined how such a method stirs up a spirit of competition among the various members of the sales force, and also how it enables the manager to keep closely in touch with his men.

Salesmen's Expense Accounts.—The old-fashioned super-temperamental type of salesman regards any inquiry into his expense account as reflection on his integrity. The more he has to say about outraged honor and stifled initiative, the closer should he be watched. The man of this type who carries his bluster so far as to resign, usually quits in order to avoid being fired. He knows his expense account won't stand the light of publicity. As for the manager, he should have the expense-account data compiled in such a way as to reflect true conditions, and he should have expenditures segregated according to territories, with road expense per day separated from city sales expense, when men are traveling only a portion of their time. If he does these things, he will secure information which will allow him to discuss conditions fully and frankly with his sales department without any fear that his criticism will be of the unjust kind which takes the "pep" out of a salesman faster than anything else. (Figure 77.)

It is very important for the man who is directing the sales policy of a large concern to keep himself informed upon the extent and activity of his market. Suppose every salesman who visits a town is asked to compile a list of all those who use his company's product. Suppose he is asked to visit each such prospect and determine as nearly as possible his stock, his rate of consumption or re-sale, and the probable date and quantity of his next order. Such data, properly compiled, give the executive a very clear idea of the extent of his market, and of the proportion secured by his company of all the sales made

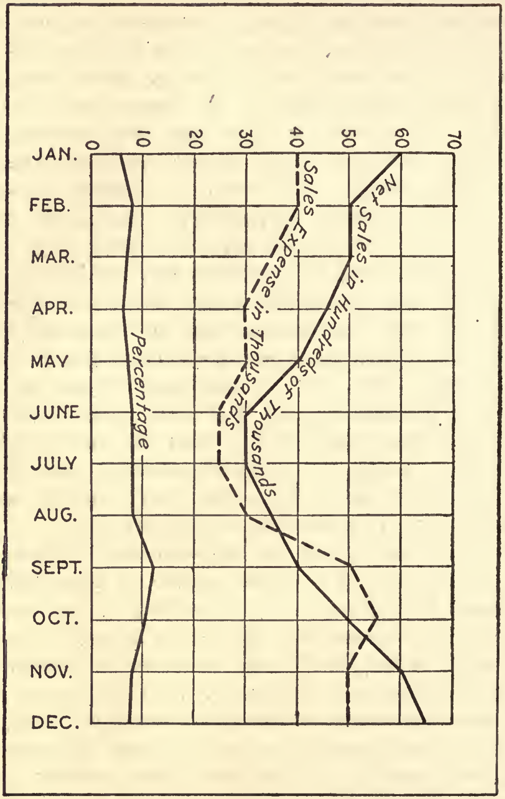


FIG. 77. CHART SHOWING RELATION BETWEEEN SALES EXPENSE AND NET SALES

in the territory. These data not only furnish him with a splendid check upon the efficiency of his sales force, but also give him a broader view of his business and render the determination of policy, as regards extension or retrenchment, a definite process of fact-analysis instead of a jump in the dark.

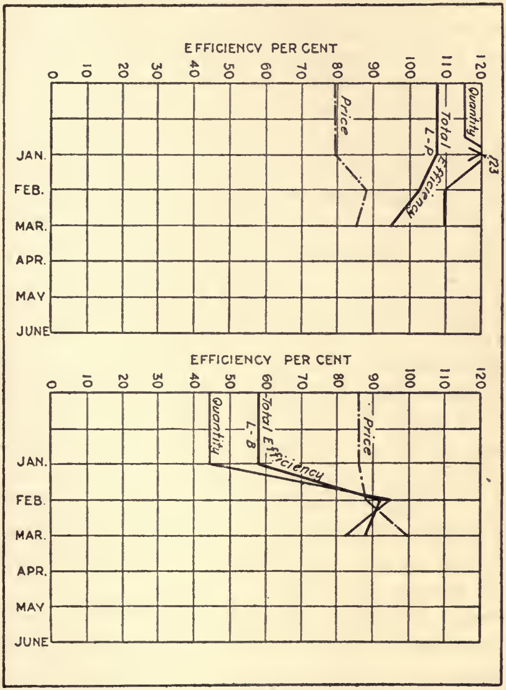
Purely Sales Statistics.—I cannot attempt to describe here the great field of purely sales statistics, which involves the planning of routes, the graphic representation of trade conditions by means of maps and colored pins, and the card-indexing of customers. The object, in compiling such statistics, is to give the new man a mass of information that will be of value to him when he reaches a town he has never visited before—information relating to every customer, even to a description of each one's special hobby, be it bulldogs or fishing. Such matters are covered in courses on salesmanship; they have no place in this volume. Charts showing sales by territories, by months, and by years, the general manager should have always before him. Maps showing where each salesman is located each day, belong in the office of the sales manager.

Scientific Management and the Sales Department.—The Tabor Manufacturing Company has applied Dr. Taylor's principles of scientific management in their sales department with the same conscientiousness and attention to detail with which it has applied them in the shop. The result is that same perfection and smoothness of operation which is the despair of every executive trained under casual management who visits their plant. Every move is planned days

ahead. Standards are set with scientific accuracy, and salesmen are paid in proportion to their accomplishment.

The movement to introduce scientific management into the sales department of manufacturing corporations, is as yet in its infancy. The general introduction of such management is by no means an impossibility, however, as has been demonstrated in a number of instances. For instance, Figures 78 and 79 illustrate a sales bonus system devised for a company manufacturing two classes of products as based on the salesman's efficiency as to price and as to quantity of sales.

The quantity to be sold in each territory (in this case, Product L-P and L-B, James Smith, salesman) was standardized a year in advance and a reasonable price was set. The standard quantity was then divided by the actual quantity sold, and the per cent equalled the quantity efficiency. Price efficiency was similarly determined. Quantity efficiency was counted twice and price efficiency once, the result was the total efficiency for the product as shown by the charts. Results were posted as shown by Figure 76. Examples would be more common if it were not for the common and erroneous belief that salesmanship means personality only, and that the best salesman must always be the sales manager. Wherever you find the true sales manager in control—the man of judicial temperament, who dissects, analyzes, and decides according to carefully collected facts—instead of the bull-necked hypnotist, who is governed by opinion, there you will find at least elements of scientific sales management.

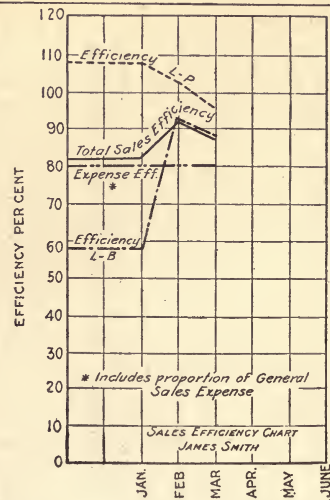


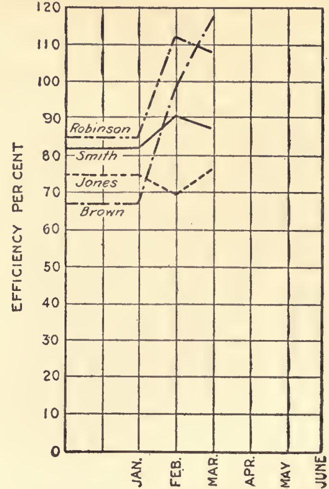
FIGS. 78 AND 79. CHARTS SHOWING SALESMAN'S EFFICIENCY OF PRICE AND OF QUANTITY ON TWO PRODUCTS

Three Classes of Business: Quality Monopoly.—A true sales monopoly is a prize which falls to comparatively few industries. The best business which the average sales manager can obtain for his firm is that in which he has a quality monopoly—or in which the customer believes he has such a monopoly. If the goods to be sold are of exceptional quality, or are enough above the average to enable his men by exertion of their personalities to persuade the prospective customer that the quality is quite exceptional, there is always a certain amount of business that can be obtained at prices above those of competitors. This means, of course, larger profits to the firm—and the greater the proportion of such business obtainable, the greater will be the firm's prosperity.

Business Secured through "Preference."—Next in point of desirability is business secured through preference. I mean by that, business, from customers who, on account of a personal friendship with some one in the firm, or special favors granted them with respect to deliveries and the like, will give a certain concern their orders, provided this firm will meet its competitors' prices. This sort of business usually carries a fair margin of profit.

Business Obtained through Price-Cutting.—The third, and least desirable, class of business is that which must be obtained by means of price-cutting—the trade of "the professional shopper" or "price-peddler"—and business from districts in which the competition is necessarily of the cut-throat variety. This kind of business usually means sales at cost, or at a loss, and if the firm that takes it wishes to





FIGS. 80 AND 81. SALES BONUS SYSTEM FOR COMPANY MAKING TWO CLASSES OF PRODUCTS (Continued)

The sales efficiency of each man was determined by averaging his efficiency on each product with his sales expense. Fig. 80 shows Smith's total sales efficiency by months. Fig. 81 shows the relative efficiency of four salesmen for the first four months under the system. (See 78 and 79.)

continue its existence, the only justification for accepting such trade is a desire either to increase the output in an attempt to reduce production costs, or to avoid the heavy losses that result from shut-downs.

Scientific Management, and Scheduling.—It goes without saying that the higher the quality of the product, the greater will be the proportion of the company's sales which will come within the first of these three classes,—and, consequently, the greater the firm's net profits and the more pleasant and profitable the work of the salesmen. Just how scientific management improves the quality of the product by making it directly to each workman's interest to safeguard that product and to exercise his ingenuity to find out how to improve its quality, has been told elsewhere.

To increase the volume of the second of these three classes of business, is the ideal of scientific salesmanship. Business obtained through preference is a tribute to the personality, the power of character analysis, and the individual skill of the salesman. It must be remembered that promptness in making deliveries is a very important factor in the success of a firm. Scientific management aids the salesmen by scheduling the product.

Every element of the finished product—whether it be an ingredient of a patent medicine, or a part of an automobile—is scheduled throughout its movement in the course of manufacture—from the time the customer's order is entered, until the finished product is shipped. The scheduling, as has been seen, covers

the ordering of materials, the following up of orders for materials, the reception of materials, the delivery of materials to workrooms, the primary and the secondary operations upon materials, the assembly of parts, the inspection of the completed product, and, finally, the shipment of the product.

If every order in the house is so scheduled, if the time of every operation is known, as a result of standardization, and if each workman is rewarded in accordance with his adherence to instructions, and to this schedule, the factory is at all times in a position to state exactly to the inquiring salesman just when delivery can be made. Consequently, the salesman knows that he is getting facts—and he also knows just what will happen to him if he stretches those facts. He is benefited in the long run, and the firm also is benefited, by an unimpeachable reputation for scrupulously fulfilling delivery promises. Other things being equal, the result of such a reputation is bound to be a transfer of a certain amount of business from the third—and least desirable class —to the second, or preferential, class. Furthermore, it should be made to the interest of the salesman to further the interest of the firm along definite and predetermined lines.

The Bonus System and Price-Cutting.—Paying a salesman a straight salary is little better than paying workmen by the day. In order that this system might be avoided, some one invented the commission system—just as some factory superintendent invented the piece-rate system as a means of escape from the day-rate method. Under ordinary circum-

stances, a commission on his sales simply insures the salesman a certain percentage of the total amount that the firm secures from those sales. Suppose that a salesman is selling boxes which cost 90 cents each, and which sell at an average price of $1.00, and that besides his salary he receives a commission of 2 per cent on his sales. If he sells 10,000 boxes, the firm receives $10,000, but from this amount must be deducted $9000 for the cost of the boxes, and $200 for the salesman's commission. The firm, then makes a net profit of $800, or 8 per cent on this man's sales.

Now assume that this salesman knows that if he should cut the price to 95 cents he could sell 12,000 boxes, and thus bring his sales up to $11,400, securing a commission of $228. But what would happen to the firm's profit? The firm would receive $11,400, and from this amount $10,800 would have to be deducted for the cost of the boxes, and $228 for the salesman's commission. The firm's net profit would then be $375, or only 3.2 per cent on this man's sales. In other words, about one third of the profit would have been sacrificed in order that this salesman might add $28 to his income.

You say, of course, that you would "fire" a salesman who would cut a price in that way—that this is an extreme case, and so on. But did you ever stop to realize that your method of paying bonuses, if it is the average method, is entirely wrong in principle? That in using it you are begging your salesmen to cut prices? That you are encouraging them to indulge their natural human weakness for making large sales, regardless of price?

You can count on the average salesman having many and plausible reasons for cutting prices. Before he cuts them, he'll probably tell you how bad the market is, in order that you may be all prepared beforehand. In most cases, you have to depend on him for your knowledge of trade conditions in his district, and it is hard to question his statements when a number of customers back him up in his report about hard times, as they generally will. By the time he gets through with his hard-luck story, you are willing to agree as to the necessity for cutting prices, and before you know it you are throwing away fifteen dollars in profits for every extra dollar he gets in commissions. Moreover, you are doing this solely because your method of paying a bonus cannot but lead him to see a necessity for cutting prices!

Such a method of payment is unfair to the conscientious salesman, who tries to hold prices up; it encourages the very situation you are exhorting your men to avoid. The commission-on-sales form of bonus is still further unfair, in that no allowances are made for differences between sales territories.

How are you going to keep the man with a poor territory, where sales are small, from growling at the advantage shown the man with the good territory—whose commission is large—when you are paying them both a bonus in the form of a commission on sales? An incentive that really is any incentive at all, must affect all concerned. Otherwise, any advantage gained will be offset by the continual dissatisfaction of those who feel themselves injured.

One dissatisfied salesman on the road usually costs a firm more than all the expenses of three extravagant salesmen.

Paying Salesmen According to Accomplishment.—Salesmen should be paid in exact proportion to what they do for their house. The immediate dollar in the form of profits, is the benefit that is usually most evident to every member of the firm and to every stockholder. Why not pay the salesman directly in proportion to the effects of his work with respect to this immediate dollar? This method is being used by some concerns without making public any cost figures or otherwise disclosing business secrets. The far sighted firm, as a matter of fact, goes further than this.

Emphasizing Desirable Qualities.—There is a certain large wholesale and jobbing concern whose executives have figured out the exact qualities which, in their opinion, constitute the ideal make-up of a salesman. Every month the sales manager checks each one of his men against this "inventory." One man may be 90 per cent on aggressiveness, 85 per cent on tact, 95 per cent on ingenuity, 90 per cent on integrity, and so on.

These percentages—some ten of them—are averaged, and each salesman's average is posted at the end of the month. The individual ratings that each man receives, however, are known only to himself. This method probably prevents embarrassment, while the posting of the average provides the incentive that the score board furnishes to the participants in sport. The sales manager, furthermore, explains to every

man exactly the reason for his mark on each qualification, and does his best, by means of helpful criticism, to assist all the salesmen to improve their averages. The result is that every man knows that his good points as well as his bad are being taken into account, and that he is not being judged by his "general impression" any more than by his popularity.

Making Ideals a Goal.—This particular company also drives their lessons home by making the size of each salesman's bonus dependent upon how nearly he attains the ideals set by the firm.

For the sake of the illustration, let us return to the case of the man who sells boxes. During the month, let us say, he has sold 1,000 boxes at $1.00 each. Under the ordinary system, granted that his commission would be 1½ per cent on his sales, he would receive $15. Under the new system, he would be allowed a commission of 2 per cent on his sales, or $20, multiplied by his "sales-quality" percentage, which, we shall assume, averaged thus:

Aggressiveness	90	per cent
Tact	85	"
Ingenuity	95	"
Integrity	90	"
Integrity	90	"
Total	450	"
Average	90	"

He would therefore receive 90 per cent of $20, or $18, as his bonus for the month, in addition to his salary.

It will be noted that integrity is counted twice. This is done purposely, in this particular case, to

R.D. Franklin

IMPERIAL MFG. CO. INDIVIDUAL SALESMEN'S RECORD

QUALITY	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL	AVE.
INTEGRITY	90	90	92											
TACT	85	87	90											
AGGRESSIVENESS	60	65	70											
INGENUITY	50	55	52											
PERSEVERANCE	70	73	75											
TOTAL	355	370	379											
AVE. FOR MONTH	71%	75%	76%											

FIG. 82. HOW THE MANAGER KEEPS IN TOUCH WITH HIS MEN

In folders like this the sales manager collects letters to and from customers, and other data for grading salesmen. At the end of each month he goes over with each salesman the material in that man's folder, and discusses plans for improvement.

show the method that some firms adopt in order to lay particular stress upon their desire for some special quality in the salesman.

As a result of using this system, the wholesale house recently mentioned has developed one of the most effective groups of salesmen in the country—and of exactly the type needed for its particular business. These salesmen know that they are working to attain certain definite and practical ideals, and that the more skilfully they get in line with these

ideals, the more hard cash it means to them each month. With them it is not merely a matter of avoiding a "call down," once or twice a year, for some flagrant offense which the firm cannot overlook, but which they stood a good chance of "slipping over." Each man knows he is continually under observation from a number of different angles, that nothing will be passed over, and that he will be rewarded exactly in proportion to the value to the company of his accomplishments.

The system has been in use for over six years now. The firm is prospering, and is sharing its prosperity with those men in its employ who attain its standards. It has the pick of the salesmen in its territory, and its men are satisfied—they are getting a square deal and they know it.

Amount of Sales per Territory.—Another firm—manufacturing building materials on a large scale—has set standards for the amount of sales it feels every territory should yield. The man covering each territory is paid a bonus which varies according to the degree to which he attains the standards. These standards are based upon the total output of the factory, and this output is divided among the various districts in proportion to the average sales of previous years. In setting these standards, however, the sales manager takes into consideration many sales factors. For example, if a certain territory had been covered for a year by a poor salesman, he would make due allowances. His intimate knowledge of trade conditions and of his market enables him to judge intelligently. Furthermore, the standards are

set for a definite period, and are subject to revision under certain prescribed circumstances—for instance, if the factory should be expanded beyond its present capacity.

In addition, a standard is set for selling expenses. The sales manager, after going over past records, consulting his own experience, and conferring with his most dependable men, determines a figure which he thinks represents the proper cost per unit for selling his various products. A standard selling price is also established, together with a minimum limit. This price is based upon the best prices obtained in the past which can be considered as fair for the period over which the standard applies. Each man is rewarded according to how nearly he attains these standards.

To return, now, to the box salesman to whom I have referred before. Suppose, this time, that the sales standard for a given territory has been set at 1,000 boxes a month, and that the sales expense has been fixed at 10 cents a box and the selling price at $1.00 a box. Assume, next, that the salesman sells for the month 950 boxes, incurs a sales expense of 11 cents for each box, and obtains a price of $1.02 for each. His percentage of attainment, with respect to the standard quantity, is then 95 per cent; the standard sales expense, 90 per cent; and the standard selling price, 102 per cent. His average effectiveness as a salesman for the period is therefore 95 per cent, and he receives for his month's work—the regular bonus table is used—20 per cent in addition to his regular salary of, say $100 or $120.

This bonus table, in abridged form, is this:

71	per cent	Efficient	0	per cent	Bonus
73	"	"	1	"	"
76	"	"	2	"	"
79	"	"	3	"	"
82	"	"	4	"	"
84	"	"	5	"	"
86	"	"	6	"	"
87	"	"	7	"	"
88	"	"	8	"	"
89	"	"	9	"	"
90	"	"	10	"	"
91	"	"	11	"	"
92	"	"	12	"	"
93	"	"	13	"	"
94	"	"	14	"	"
95	"	"	15	"	"
96	"	"	16	"	"
97	"	"	17	"	"
98	"	"	18	"	"
99	"	"	19	"	"
100	"	"	20	"	"
105	"	"	25	"	"

In this particular instance—for I refer to the case of an actual firm—the system has been working for several years, and is giving splendid results. The factory is also operated under scientific management, and it is sufficient comment upon the success of the entire system to state that the plant ran to capacity during 1914, which was an exceedingly bad year for concerns of this particular kind.

Scientific Method of Reward: Department Stores. —The method of the scientifically determined reward varying in exact proportion to the effort expended in sales work, has been applied even in the case of department stores. It has been a practice of late years

among many department stores, to conduct schools for salespeople, at considerable expense. Not one store in ten, however, has taken what is obviously the next logical step: namely, to make it directly and financially worth while for these people to profit as much as possible from the course of study that they take. A few stores, it is true, have taken the trouble to do this, and to pay the members of their sales forces not only in proportion to individual sales volumes, but also in proportion to their observance of certain store rules and their grasp of the training-school teachings.

These stores use much the same sort of system that I have described in connection with the wholesale and jobbing concern. Standards are set for the attainment of such accomplishments as, for instance, a commendable degree of legibility and correctness in writing customers' names and addresses upon sales slips; incivility to a customer is punished with a heavy penalty. The floor managers give to the various salespeople certain arbitrary ratings based upon the managers' observation of the employees during the month.

This system has been applied also in one store's delivery service. Drivers are marked for the following deficiences, and a marked improvement has been effected in delivery service:

1. Failure to make calls for merchandise to be returned.
2. Failure to make deliveries, even when the address is written correctly.

3. Failure to deliver bulk merchandise to the rear doors of residences.
4. Discourtesy (Counts three times).
5. Delaying deliveries.
6. Breaking or damaging goods.
7. Failure to provide change on C.O.D. deliveries.
8. Miscellaneous shortcomings not covered by the above stipulations.

The firm then rewards the ten men scoring the highest for the month, by adding $10 to the monthly wages of each.

Individual Methods Vary.—A scientific method of applying a bonus system of rewarding salesmen, must be worked out by each individual concern. There is no panacea for all the evils that usually result from unfair methods of payment. The conditions of each case must be studied, in order that the best method and its correct application may be determined. The principle is, however, in all cases the same; reward in exact proportion to intelligence, effort, and accomplishment; a fair deal; and a liberal use of common sense.

It must be remembered that the first step in this connection, as in the operation of the factory, is to collect statistics. The general manager who will analyze his business, determine which sales facts are vital and which are superfluous, and then insist upon the collection of such facts, will after a year or two be surprised to find how much that he thought was

due to chance, "hard times," and other vague causes, is due to the operation of definite and determinable laws and to rank inefficiency on the part of temperamental salesmen. After that, his way is comparatively easy: inefficiency should not be tolerated—discharge is the simplest course; careful training, the wisest. The so-called temperamental salesman under proper counsel will develop surprising capacity.

CHAPTER XX

ADMINISTRATION AND FINANCE

Charging to Costs the Interest on Investment.—Before passing to the consideration of the methods by which the executive may control those other expenditures—and incidentally the return in effort, and so in results—expenditures which, together with those already described, constitute the total cost of operating the business, I wish to say a few final words in regard to costs. I have covered the statistical control of (1) labor* and (2) material; the distribution of (3) charges I do not propose to discuss, since the subject lies properly within the province of the volume on costs.**

There is still considerable discussion of the question of charging to the cost of production interest on the appraised valuation of the property, in order to make certain that prices will be set sufficiently high to insure a return on invested capital equal to what it would bring if invested in gilt-edged securities (C-D-4 etc.). Those at the head of large corporations do not take kindly to this idea at first, because it seems as if such a course would at once raise the cost

* See Classification of Accounts, Chapter V.

** See "Industrial Cost Finding," N. T. Ficker, Vol. 5, Factory Management Course.

of production and reduce the net profits. Since the continuance in office of these executives is in many cases dependent upon the showing they can make in the way of earnings, they feel that it would be suicidal to encourage a scheme which at first seems to lop off a sum sufficient to pay a five or six per cent dividend. It is perhaps true that the plan calls undue attention to over-capitalization and to the unequal earning power of different plants and properties belonging to a company. But after all, a knowledge of these points is a very good stimulus to the executive in most cases, as I shall show later. The principal value of charging to the costs interest upon the investment, lies in the completeness and exactness with which, under such a system, each department is charged with its share of the total investment. There is no reason why this interest, having been charged as described, month by month, should not be subtracted from the cost of production in a lump sum before the production cost is subtracted from the sales cost in the monthly statement that shows the company's profit or loss for the period. The executive's showing will be quite as good under such circumstances as when old-fashioned methods are employed. Should he feel, however, that an accounting method of this kind would not be understood by his directors, another method, somewhat less exact, may be adopted.

Another Accounting Method.—The following tabulation shows a business consisting of three factories, two mines, the necessary hotel and store, and a real estate company formed for the purpose of segregating more or less non-productive lands. These lands

JANUARY INVESTMENT RETURN							
Property	Investment	Monthly Profit	Annual % Rate	Monthly Loss	Annual % Rate	Monthly Net Profit	Annual % Rate
Factory No. 1	$ 500,000	$ 4,160	10				
Factory No. 2	250,000			$4,160	20		
Factory No. 3	2,000,000	8,330	5				
Coal Mine No. 1.....	120,000	1,000	10				
Coal Mine No. 2.....	1,000,000			2,500	3		
Hotel........	25,000			208	10		
Store........	50,000	83	2				
Real Estate Co.........	350,000			875	3		
Total.....	$4,295,000	$13,573		$7,743		$5,830	1.6

the company bought at various times in the past as possible factory property, or in order to secure mineral rights. It hopes to dispose of them eventually at a profit, and meantime does not feel like carrying as them dead weight balanced against the earnings of its actively productive properties.

The company's investment amounts to $4,295,000. The total net earnings for January amount to $5,830, which is at the rate of 1.6 per cent a year. The tabulation shows just which portions of the property were productive in terms of annual dividends upon the capital invested. Under the circumstances, the attention of the executive cannot but be focused upon the properties that are dragging down the net profits. This information is entered upon a chart,

which shows him just how well or how poorly each division of the company's investment is doing each month. The chart illustrated, Figure 83, shows each property as of equal importance. Strictly speaking, however, that is not the case. The method of charting net earnings was shown in an earlier chapter. This chart is designed to bring home to the management each month the fact that each property should be regarded as a separate entity, and as such should earn dividends.

Incidentally, a heated argument is raging at present as to the valuation which should properly be selected as a basis for computing earnings. In other words, the question is whether a company should regard as its true capital the assessed valuation of the property—the amount actually invested by stockholders—or the amount actually invested, plus all the stock dividends paid in past years, in terms of stock outstanding, plus treasury stock. I shall not attempt to settle this controversy. I do believe, however, that every executive should at least once a year retire into his private office, double-lock the doors if necessary, squeeze all the water out of the capitalization of his company, and look the facts honestly in the face. This procedure will not be pleasant, perhaps, but the company will benefit by it in the long run.

General Charges.—I discussed in the preceding chapter methods of controlling sales charges. There remain for treatment, therefore, only (4) Administration and (6) General Charges. In regard to the latter we can only say that the less charged under

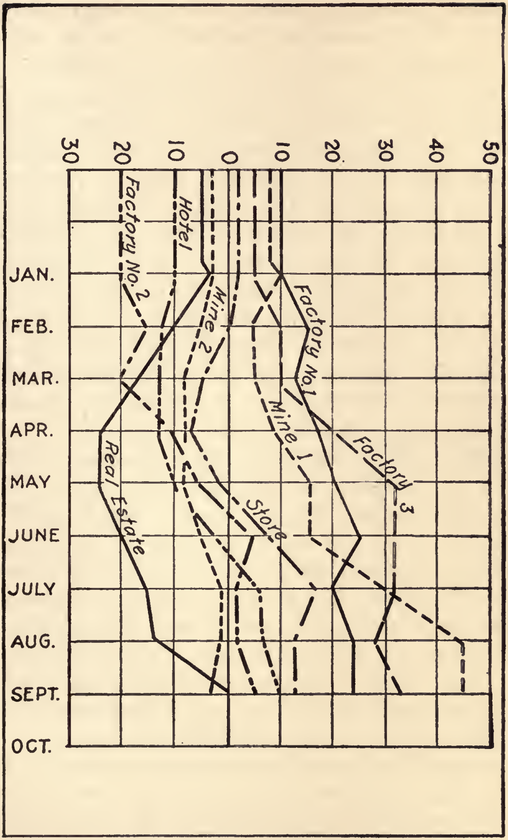


FIG. 83. CHART SHOWING RETURN ON INVESTMENT

"general" heads, the better. Such charges are the delight of the accountant too lazy to think out the proper distribution of a charge, and they are the lurking places of dishonesty and inefficiency. The salesman who wishes to pad his expense account revels in charging to "Incidentals" or "General." The foreman who is carrying two or three extra names on the payroll, and adding the wages of fictitious workers to his salary, ascribes their imaginary activities to "general work." When it comes to the charges compiled under the direction of the company's auditor, the less opportunity offered for dishonesty by providing such catch-alls the better, if the executive desires to feel sure at all times that the expenditures for which he is responsible are being made honorably and efficiently.

Administration Charges.—Administration expense should be regarded in much the same light. There are always certain charges which cannot be distributed accurately. A fairly safe rule is: Reduce such charges to a minimum, and chart them proportionally against operation and against sales in the form of a percentage of net sales and of cost of operation. A chart keeps these charges before the executive in such form that he realizes very quickly the necessity for strenuous exertion or for retrenchment when business falls off. (See Figure 84.)

In using such a chart, the executive must take care not to fall into the fallacy of the country-town banker, and argue that increase in the ratio of overhead to productive expense necessarily spells disaster. If that were true, the Tabor Manufacturing

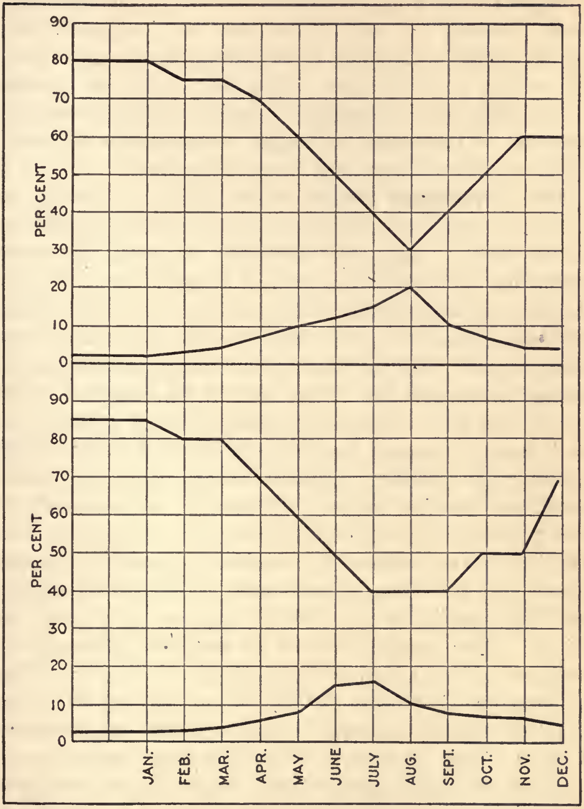


FIG. 84. PERCENTAGE OF ADMINISTRATIVE EXPENSE TO COST OF OPERATION, ABOVE, AND TO NET SALES, BELOW

Company would be ranked as one of the most inefficient, instead of one of the most efficient, concerns in the country and Scientific Management would be classed as a rank failure. The chart must be viewed in the light of its context; in this case, the context consists of the charts showing the efficiency of operation of both factory and sales department.

The Investment Phase.—One phase of finance is usually taught the executive by his banker and by his attorney. Upon his accession to power, he very soon finds that there are certain things which he may do, and certain things which he must not do. The method of financing rests largely with the executive's two advisers, but he alone can determine how much money he needs, and when he will be likely to need it. A few years ago coal dealers worked themselves and their equipment hard all winter, and did little or nothing all summer. Interest on idle equipment and unearned salaries during the summer, ate up most of the profits made during the winter. Artificial ice-makinig later became a commercial possibility, and now there are scores of concerns that use their offices and equipment to sell ice in summer and coal in winter. For similar reasons of economy, some firms sell ice cream in summer and oysters in winter. The ice-skating rink that flourishes on top of the big hotel in winter, becomes a roof garden in summer. I know of one instance in which the building that contained a swimming pool in the summer was turned into a moving picture theatre every winter. Irrespective of the form which this kind of phenomenon assumes, the cause is the same—an effort to simplify

the matter of financing, and so add to the profits of the house.

In many cases, the very life of the business depends upon the care with which the method of finance is studied before the business is launched. A friend of mine who had a fixed income used to consider carefully the amounts and "dates due" of all his various real-estate and other payments, before taking out a life-insurance policy or incurring any other obligations. Otherwise, he might have been seriously embarrassed at times by having all his payments come due at once. Investors must keep accurate record of the time when their various notes will become due, when coupons are to be clipped, and of all the items of income and outgo, if they are to keep their funds working for them at all times so as to secure the maximum income.

Too many corporation executives regard the investment side of their business of so little importance as to require no consideration beyond merely seeing that there is sufficient money in the bank to pay wages and salaries and the current bills. One man I knew used to keep from fifty to eighty thousand dollars in the bank all the time. He had bills the payment of which he put off for so long that eventually his credit became impaired enough to cause him serious financial embarrassment. He was careful to discount all bills not marked "net"; but the interest on the money that he kept in his drawing account, if he had paid all his bills and invested the surplus, would have amounted to enough to equal a cash discount on all net bills.

Outside Securities.—Those who control the finances of a corporation would usually do well to consider the investment of a certain percentage of their profits in outside securities. In times of crisis, a sinking fund of this sort may save the business. As industry exists in America, it very often happens that business is exceedingly slack in one line, while at the same time it is active and profitable in another. Insurance companies, universities, and savings banks never tie up all their capital in one class of investments.

The Danger of Over-Expansion.—Why should not manufacturers, by taking the same precaution, similarly insure themselves income enough to carry them safely through the lean periods, instead of driving "full steam" ahead all the time, sinking in expansion every cent they can make, regardless of whether or not the market really exists for the amount of product they propose to dump on the public? Industrial over-expansion has been the curse of the country —it has led to cut-throat competition and to the wasting of an endless amount of capital. Let the conscientious executive occasionally lay aside his pride in the business and his optimism long enough to consider at least the population of the district that freight rates will allow him to reach. Let him do some figuring upon the probable per capita absorptive power of his market, and then resist "tooth and nail" expansion beyond the limits of an output that can be sold at a profit. We have had too much megalomania in America—too much big idea—too much dreaming of ourselves as the biggest men in the biggest building in the biggest city, running the biggest business.

Let us strive rather to have the best-run business in the best city. Let us cease to spread ourselves out so thin—and make quality our slogan rather than quantity.

Distributing Dividends Evenly.—I have spoken, in a previous chapter, of the danger of accustoming stockholders to larger dividends for a year or two than the business may reasonably be expected to pay continuously. To do so is unfair to the business and to the stockholders, for such periods of artificial plenty are bound to be followed by lean periods which can only jeopardize the market value of the company's securities and hamper the business when it comes to financing. When a concern pays twenty or thirty per cent for two or three years, and then passes dividends, bankers and investors alike suspect the worst. This lack of public confidence renders it impossible for a stockholder to dispose of his stock, and makes the bank chary about advancing funds to the corporation, even for legitimate purposes. The largest and most conservatively managed corporations, recognizing this fact, usually limit their dividends sufficiently during the periods of large earnings to enable them to continue reasonable dividends throughout periods when earnings are small. As a result, their securities normally have a steadier market value, and both corporation and stockholders are saved from possible financial embarrassment.

Predicting Income and Operating Expenses.—The accompanying chart, Figure 85, illustrates an approved method of determining the extent to which

a business should be expected to require financing during the year. The business represented is typical of a number that have seasonal fluctuations.

Briefly, it is assumed that the income from sales is large during the winter months, and that it falls off during the summer. Nevertheless, in order to keep the organization intact, it is necessary to manufacture to a certain extent during the slack summer months. It is assumed, for the sake of simplicity, that expenditures may be classified under the following heads: Payroll (A), Material (B), Quarterly Dividends on Common Stock (C), Semi-annual Dividend on Preferred Stock (D), and Bonds Maturing in October (E). The sum of all these determined and estimated expenditures, is shown by the line marked "Operating Expenses and Obligations" (F). The sum of the items A to E, inclusive, is found mechanically each month by measuring off on the monthly vertical, with a pair of dividers, the distance that each unit of expenditure occupies.

The distance then between line G, Income from Sales, and line F, represents the surplus or the deficit each month, granted that there were no funds in the bank January 1st. It will be noted that the business in question had a bank balance until July, when it became necessary to borrow $5000. More and more money was borrowed until August, when obligations amounted to $45,000. From August on, notes were taken up until November, when the company had a surplus of $20,000 in the bank. By December this amount had increased to $70,000, a figure which shows that the Company had met all obliga-

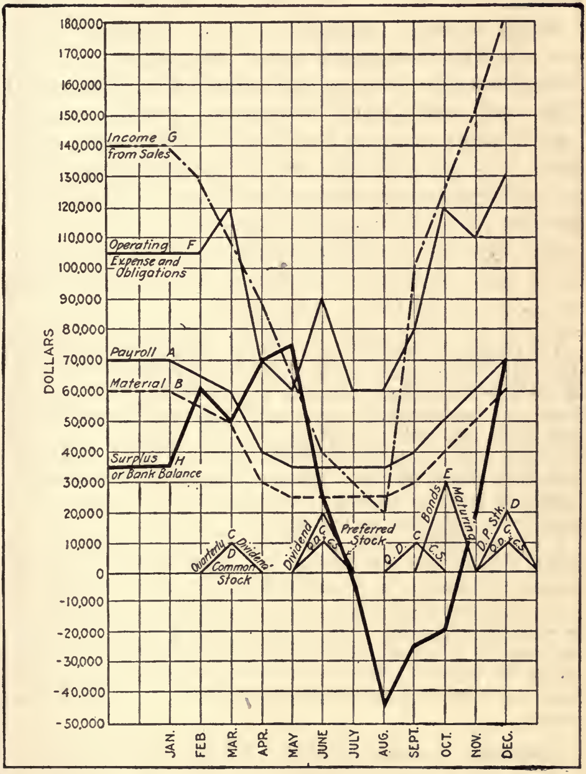


FIG. 85. CHART FOR ESTIMATING FINANCIAL REQUIREMENTS

tions and had acquired a surplus equal to that amount.

Study of Past Records.—If the probable income and operating expenses are to be predicted a year ahead, records of past years must be studied carefully and intelligently. There is nothing particularly revolutionary in such a plan. Similar methods have been used by the British Government and by the governments of other countries for years, under the name of the "budget system."

In regard to the budget system which he had devised, the treasurer of the largest company in its line in the world wrote me as follows:

> The budget, or task system has given us considerable trouble this year, owing to the abnormalities in business. However, it did one thing that probably has never been done in the history of business before—namely, it brought us up with a jerk after the first six months were over, face to face with conditions that were so far different from those which had been anticipated that we were able to develop new plans immediately for the balance of the year which would make it possible to make our budget good.
>
> I am pleased beyond measure with the seriousness with which our budget calculations are regarded by the various executives who are and should be interested. Perhaps the real factor responsible for making our budgets something to be studied, is the fact that in addition to explaining the differences up or down, we have also been able to point in detail to the concrete reasons for these differences, and in some instances they were a surprise to the department heads themselves.

Charting Actual Income and Expenditure.—It is a very good plan to chart the actual as well as the anticipated expenditure and income, since the chart will show exactly how accurately performance paral-

lels prediction each month, and will render readjustment possible every month. One man I know, who is the head of a very large corporation, takes such a chart to his bank whenever he feels it wise to outline his probable future needs, and uses it as a basis for his discussions. He arranges for his loans in a manner which has been the admiration of all the other officers of the institution. If every corporation head would do likewise, the problems of our financial institutions would be immensely simplified, much unwise expenditure would be prevented, and undoubtedly in some cases financial disaster would be averted.

Not Too Many Charts.—There are many other conditions that may be charted to advantage. In some kinds of business it is very well worth while to show every month, or even every week, the bills payable and the bills receivable. A chart showing the age and the total amount of the bills receivable is a spur to the collection department. Countless charts of a similar nature may be devised. In fact, once the personnel of an organization has been thoroughly imbued with the idea of presenting facts graphically, the greatest danger is that so much time will be spent by various executives devising graphs, that their regular work will suffer. Never should more charts be devised than can be made to "earn their keep."

Production Costs.—Before taking leave of the graphic method of executive control, I wish to say a final word regarding production costs as such. Under normal conditions of operation, if costs are

properly compiled with due regard for their value as a means of controlling the efficiency of the business, those costs alone are sufficient guide to the executive when he is deciding matters of policy. Under abnormal conditions—during such a period as that of the great European war—with wages jumping as much as ten per cent a month in some sections, and with the prices of materials advancing by leaps and bounds, usually a lap or two ahead of the wage raises — under such conditions, the value of costs for purposes of comparison, for setting one month against another, is lessened considerably. This statement is perhaps best illustrated by the two accompanying charts, Figures 86 and 87.

These charts show what was actually accomplished through the introduction of scientific industrial efficiency in two plants, as compared with what the costs showed had been accomplished. While the saving is material, even when the costs are accepted at their face value, the economies effected are much greater when allowance is made for the war-time rise in the cost of labor and material. I therefore advise the executive who would measure the true efficiency of his business at all times, to arrange for various checks of an exact nature—standards which will not vary—such as the man-hours required to perform certain operations, and the number of men required to operate the various machines or to produce a certain output under standard conditions. Standards of this sort will not change with the wage rate. Similar standards of measure for material may be set, and the complete record that these give will en-

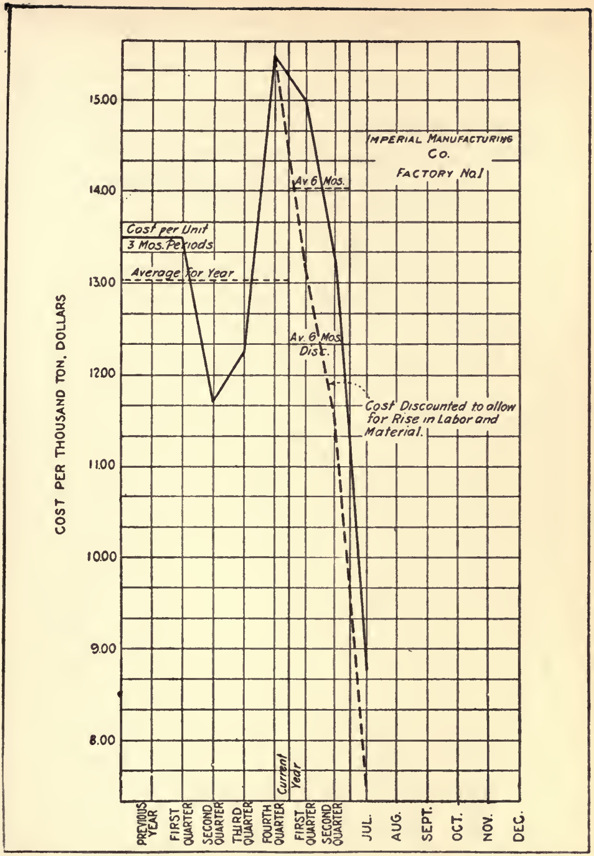


FIG. 86. CHART SHOWING ACTUAL ECONOMY EFFECTED BY INTRODUCTION OF SCIENTIFIC MANAGEMENT AS AGAINST THE ECONOMY SHOWN BY COST FIGURES

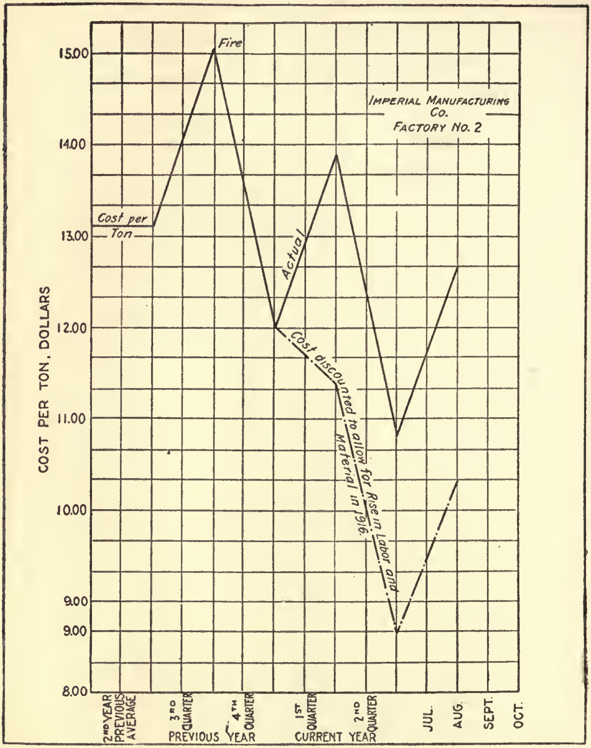


FIG. 87. ANOTHER INSTANCE OF COSTS SHOWING FALSELY THE ECONOMIES EFFECTED BY SCIENTIFIC MANAGEMENT

able the executive to estimate very closely just how much rising costs must be discounted to restore to them their comparative value, which is so important if every department is to be continuously operated at the highest possible effectiveness.

CHAPTER XXI

SCIENTIFIC MANAGEMENT FOR THE FACTORY OF MODERATE SIZE*

The Usual Type of Manager.—The factory employing from a hundred to three hundred men is frequently owned by a single individual, or, if the company is incorporated, the management is dominated by the heaviest stockholder to such an extent that the result is the same. This man may not be actively engaged in the business of manufacture—quite frequently is not—but nevertheless his influence is strongly felt in matters touching the general business policy, the expenditures, and innovations of any sort.

The manager of the business, who may or may not have had manufacturing experience, is often the sales manager—in fact, if not in name—and presides over the general office of the company. He is looked to for results, but must keep well within the limits of the company's policy as laid down according to the doctrines of the dominant stockholder. Heresy of any kind on his part is likely to result in personal disaster.

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* This account has to do with my personal experience as a factory executive in introducing some of the methods described in the foregoing pages into factories of which I was superintendent. This article appeared in "The Engineering Magazine," and I submit it here with the idea that it may prove helpful to men who are in situations similar to those in which I was placed.

One of the most firmly established tenets in the creed of the successful business man is that it is essential to insist upon the utter extermination of unproductive labor. No one will dispute the soundness of that reasoning, provided the labor so designated assists in no way whatever the process of manufacture. Too often, however, since the man whose brain only is active differs not greatly in appearance from the man who is loafing, the fact that an employee is neither rushing about nor actively engaged in manual labor causes him to be condemned as useless, and his services are dispensed with. The man who invests heavily in the stock of the company very often knows a good deal about bookkeeping, and since he visits the factory to better it, he will readily criticise any apparent excess of men in this department, while fear of showing his ignorance would cause him to hesitate a long time before expressing an adverse opinion concerning the number of men actually engaged in the work of manufacture. The manager and the superintendent must please their superior, and so are extremely loth to sanction in any way an increase in "apparently unproductive labor." When lack of profits force retrenchment, the clerical force is always the first to be attacked, and the efficiency of the executive is often badly impaired by the consequent lack of necessary figures. Even some very successful business men go so far as to view with great alarm the acquisition of anything in the nature of office furniture by a superintendent, fearing that he may be tempted to loll in idleness when he ought to be rushing about

among his men. They feel that they are getting their money's worth when he is wearing out shoe leather, which he pays for, but they are not so sure of it when he is sitting at a desk working his brains and using paper and pencil, which they pay for. This may seem to be an exaggeration, but nevertheless the two commonest criticisms applied to managers and superintendents are, "The business is too top heavy," and "He has too many men standing around."

Difficulties of Introducing Scientific Management.—Human nature being what it is, and the successful owner having pretty definite ideas as to who is responsible for his success and as to just how it is obtained, what chance has the efficiency engineer of foisting upon the average small business the paraphernalia of Staff and Line, Routing, Dispatching, and Time-Study, with their Chief of Staff, Supervisors of Study, of Planning, of Standards, of Bonus, of Analysis, and so on, together with each one's clerks, messengers, and other assistants? The result of such an attempt would be too awful to contemplate. How then is the small or medium-sized enterprise to obtain the benefits which can unquestionably be obtained by the introduction of the principles of Scientific Management?

Evolution of the Superintendent (Staff)—Assistant Superintendent (Line) Idea.—In 1906 I was placed in charge of a factory in the Far West which employed a hundred men. The plant was in a chaotic condition, having just passed through an interregnum under a foreman, after a year under a superintendent whose troubles had driven him to drink. The old-

timers in charge of various departments were at war with each other; each had designs upon the superintendency, and all looked upon a college graduate as some sort of animal designed rather to amuse than to alarm. As a result, I spent the first few weeks in rushing about from one department to another, trying to get each one patched up to run long enough so that the factory could be operated as a whole. When this had been accomplished the factory was limping to such an extent that it was realized that each department and each material would have to be analyzed and great improvements made before anything like efficient operation could be looked for. Meantime the factory had to be run, and it took all of one man's time to straighten out the snarls arising in each department and keep the product coming. This forced me to recognize the following principle:

The factory should be so organized that it will run itself, leaving the superintendent free to throw his strength to the aid of the weakest department.

Application of the Principle.—This idea was worked out in practice by gradually evolving from the most promising material at hand a line organization under an assistant superintendent. This organization handled all the routine operations of manufacture, leaving the superintendent free to meet any emergency of an extraordinary nature and to do analytical and research work—made him, in a measure, chief of staff. It seemed logical that the highest-salaried official about the plant should be best able to study and improve the various operations, and the opportunity to do this was secured. When necessary

assistants were detailed from the different departments, and the scope of certain foremen who were expert in certain operations was extended to cover other departments, so far as these operations were concerned. The course of the product through the factory was studied and changes made which facilitated its movement. The assistant superintendent made the dispatching one of his duties, and a sufficient supply of raw and semi-manufactured material was assured each department. Processes were studied and unnecessary labor eliminated. All finished products not strictly first-quality were classified according to their defects and the causes removed so far as possible. The written instruction card was adopted for the most important operations after a thorough analysis and determination of the best method by a process of elimination. Outside expert assistance was called in when necessary; other plants were visited, and the experience of the best workmen made available. Machines were improved, and in some cases new varieties were substituted. This type of staff organization, as will be seen, permits the careful investigation of various problems, but at the same time, on account of its great flexibility, its expense is no greater than the occasion demands.

Results as to Fuel.—As the system began to operate more smoothly, the results were evident. Fuels were investigated, and a more efficient type of furnace reduced power costs. By the use of indicator diagrams power was increased and steam consumption decreased. Gauges recorded the conscientious

performance of the duties of the night crew. Shutdowns on the more important machines were diminished when recording gauges were installed which showed their duration and frequency. Technical control on all furnace operations saved fuel and improved quality. Conveying and unloading plants were installed, which cheapened the cost of handling raw materials and fuel. Methods were adopted which lessened the damage to parts in transit from one department to another. Staff methods of investigation applied to every department decreased costs and improved quality.

Results as to Output.—For the first few months it was impossible to determine the exact balance of the plant, as the maximum output for each department was not known. As soon as this could be ascertained, however, weak departments were strengthened by the addition of equipment, men, or special attention, until a continuous pull was exerted upon the product throughout the course of its movement through the factory. The way some departments expanded when cramping conditions were removed, was astonishing. As a result, responsibility for delays was placed where it belonged, and the output of the plant was increased nearly 50 per cent.

Results as to Costs.—The cost system was overhauled, useless work eliminated, and the balance so arranged as to emphasize variations from the normal in such a way that they would receive immediate attention. The cost of vital or governing operations was figured daily, so that the executive knew each morning what efficiency had been attained the day

previous. The shipping department was reorganized along lines which would make mistakes difficult; and the $150,000 stock of manufactured goods which it was necessary to carry was recorded on a continuous card-inventory in such a way that the office knew the supply of each variety at all times, and therefore could safely promise delivery or manufacture new stock to remedy deficiencies. The time of all workmen was distributed against the proper operation, so that prompt and reliable records were secured. All clerical work was so systematized that, with the exception of the formal bookkeeping, it could be done by one man, in spite of the fact that sales usually amounted to over $400,000 a year.

Results as to Labor.—Labor conditions were improved as time went on. About three-quarters of the men were paid by the day, and the rest were under the task system. Good results were obtained with the latter, as the time allowed for the tasks was never cut, although one or two adjustments had to be made in the rate per hour to suit conditions in the district. The efficiency of the day-workers, of course, depended largely upon the driving ability and the personality of the foremen, but everything was done to remove obstacles to rapid performance and to make working conditions comfortable. Definite records were kept of the daily production of each man or crew, so that any urging to further efforts were as intelligent as is possible under the day-labor system.

Wherever possible it was made easier to do the right thing than the wrong, and it was generally so contrived that the persistent wrong-doer was sooner

or later "hoist with his own petard." The adoption of this principle, while it requires absolute fairness, a knowledge of human nature, and some intuition, elevates the general tone of an organization to a marked degree, as apparent Fate is a much more terrible opponent than the usual flesh-and-blood boss.

Every effort was made to get the workmen to tell the truth when a fault resulted in loss, on the theory that if all the causes for a defect were known the defect could often be remedied or the reason for the mistake or shortcoming of the workman intelligently removed, while if some factor were concealed, wrong conclusions would be reached. In fact, in one or two departments the workmen knew that a lie meant instant discharge, while the most flagrant offense, if honestly explained, meant at the most a lay-off. This resulted in a mutual trust and frankness between the executive and the workmen.

The adoption of this system of Staff and Line organization cut the labor cost in less than two years from 20 to 30 per cent, and increased the output 50 per cent and the quality 20 per cent.

Further Application of the System.—After a few years the system was installed by the same company in its other factories. In one, the introduction of the system allowed the superintendent sufficient time to exercise a latent inventive genius, which revolutionized a considerable branch of manufacture. The output of one machine which had never in the history of the business exceeded 5000 units a day, was increased to 13,000 with little increase in the operating crew. All sorts of articles were manufactured which

had been impossible before, and great improvements in quality were made. The company became possessed of a number of valuable patents, workmen were rewarded for their inventive genius, and ingenuity was stimulated.

Record outputs for various machines and quality records were circulated among the different factories, and successful emulation was rewarded. Output increased, quality improved, and costs decreased. The best brains were released from routine, and the results were of incalculable value to the company.

In all, this system was installed in six different factories, and the invariable result was lower costs, increased output, and improved quality. Later it was sucessfully adapted to the operation of mines and quarries, always with beneficial results.

Application of Scientific Management.—In 1911 the principles of Scientific Management were definitely stated in book form by Taylor and Emerson. Their importance was immediately apparent to me, and in so far as I was able I applied them to the operations of the various plants. Belting was standardized and repairs analyzed. In one plant alone the cost of repair parts in one department was cut over $1200 a year—33 per cent. The cost of oil in one factory was reduced nearly $1500 a year, or 50 per cent. Wherever applied, the principles effected a great saving—but that is another story. The point is that it was proved that the Superintendent-Staff, Assistant Superintendent-Line Organization was adapted to carrying out the principles of Scientific Management in the factory of moderate size.

Meeting the Conditions.—These principles are overwhelming in their logic. It is the machinery of the thing that terrifies the owner of the small factory. The industrial Engineer does not get very far with his "staff paralleling the Line," "Keeping costs on the operations of each man," "Planning and Dispatching Departments," and so on, before his explanations are drowned by cries of "red tape," "too much overhead," "too much system," "our business wouldn't stand it," and the factory is denied the privileges which it is admitted the large plant can afford.

On the other hand, the plan of freeing the superintendent from routine—making him work his brains, and therefore not wasting any of his high salary in semi-physical labor which a cheaper man can do as well—seems logical and contains nothing revolutionary. The plan is one which appeals also to the superintendent. He still has his authority over his men, in case he wishes to exercise it. His prestige is in no way diminished. To maintain discipline and to avoid inroads upon his time, he must give orders only through the assistant superintendent; but the good executive will regard this as no curtailment of authority.

If the business is so small that the superintendent, by calling on one or two of the regular departments for assistance from time to time, can keep the principles of Scientific Management in operation, the benefit is secured. After the Industrial Engineer has made the analytical time-studies and shown him how to continue them on the more simple operations, he

can keep this part of the system up and revise the written instruction cards from time to time with occasional help from the engineer. The bonus system once established, the superintendent can make such slight adjustments as are necessary. Dispatching, perhaps, takes part of a clerk's time, some of his regular foreman's time, and demands occasional attention from the assistant superintendent. Routing, once established by the engineer, needs little attention. The same foremen become rather more specialists, and, with little increase in expense, functional foremanship is established. The repair man who is required to keep certain records in conjunction with the man who has charge of the storehouse, is told to do a little more thinking, and to let his helper do more of the manual labor; before long, with the engineer's help, standardized repairs are an accomplished fact. All this is very crude and is adapted to only the smallest sort of factory. The system is flexible, however, so that the plan outlined above may be expanded. An assistant foreman may be created here and there, specialists made of the various repair men, and the activities of staff officials removed a little more from the line until the conventional Staff and Line organization recommended for the large factory is reached.

To be successful, the principles of Scientific Management must be rigidly adhered to, no matter how small the factory. The services of the best Industrial Engineer available should be secured, and exactly what is contemplated must be thoroughly understood by the owner and the executives.

CHAPTER XXII

CONCLUSION

Important Opinions: Educational and Governmental.—By way of laying final emphasis upon the idea that facts must be brought to the executive's attention, accurately, forcefully, and continually, I wish first to cite two authorities, the one educational, the other governmental.

In the official Register of Harvard University—Volume XII, Part 6, covering the Graduate School of Business Administration—there is the following important statement:

> In the last twenty years the business world has come to see new value and new uses in accounts; and accountants have realized the necessity of constructing accounts so that they shall tell the operating manager what he needs to know about his business. Indeed, it may now be said that no business is conducted successfully, or can be long so conducted, unless some one is constantly analyzing that business and presenting the result of that analysis in a clear statement. Such analysis and statement is the accountant's task; and it is a very different task from that of the bookkeeper. The person who is a mere bookkeeper records known facts; the accountant, by scientific analysis, learns the facts to be recorded, or directs the bookkeeper in recording the known facts in such fashion that the unknown facts may be learned.

Proper accounting for productive enterprises requires something more than the determination of costs. The accounts should show criteria not only for judging the effectiveness of labor and of materials, and for determining the amounts and causes of waste, but also for establishing certain standards of both accomplishment and cost.

Business management depends for its success upon a careful analysis of facts; and many of these facts can best be presented in statistical form. In practically every kind of business, and by establishments of all sizes, properly selected statistics can be advantageously utilized. Statistics are used in establishing standards, testing efficiency, detecting waste, and furnishing a guide for future plans.

An analysis of any business problem shows not only its relation to other problems in the same group, but also the intimate connection of groups. For example, not only is any problem of factory management related to other problems in the factory, and any problem of selling related to other problems in the sales department, but also these groups of problems are interdependent. No problem in business is purely intra-departmental. Furthermore, within each department there must be preserved a uniform principle of balance. In preserving this balance, it is necessary for the management to maintain a certain detached position where neither personal bias nor immersion in detail will affect the policy laid down. Finally, in analyzing the problem, a definite and ordered method of approach is set up.

The closing paragraphs of the Federal Trade Commission's bulletin entitled "Fundamentals of a Cost System for Manufacturers," bear a particularly important relation to the subject of this text:

In every manufacturing business there are bound to occur leaks, either of material, labor, or expense. If statistics are kept showing the amount of material necessary to do certain

classes of work, the amount of labor, and the amount of overhead expense, an increase in any of these items will be revealed by a comparison, and the executive will be in a position to say that after a few of these matters have been taken up with the factory, the factory people will exercise a little more care, not only in the use of the material but in the time they spend on the work. A cost system with forms properly designed for giving statistical information, is of the greatest aid to factory efficiency.

A system will not run itself; neither will it in itself reduce costs or increase efficiency. This is strictly up to the manufacturer himself. A system will give him the information, and if this information is properly used, he will unquestionably find that his system is not an item of expense, but a very valuable asset.

If a manufacturer purchases a new machine before his old one is worn out, he does so because he expects the amount expended to increase his profits, either through economy in operation or through an increase in production. He looks on this as an investment, and not an expense. Office methods have been improved to quite as large an extent as machinery, and an investment in improved methods will produce a return just as will an investment in improved machinery.

One of the strongest arguments in favor of installing a practical cost system, is the fact that every manufacturer who has installed one, and who has operated it for at least a year, is firmly convinced that it is a paying proposition.

The Federal Trade Commission is urging manufacturers to give the subject of accurate costs the attention it deserves. It has found that unreliable costs of production and distribution cause a great deal of unfair competition and a heavy business death rate.

While the claim is not made that a cost system will save a man from failure, the claim is made that a man who knows where he stands day by day, is very much less likely to make

a failure of his business than one who is directing his business by guess work.

To the executive who is considering the installation of a system of statistical control, I would speak one special word of warning. Some executives feel that they can buy so much "efficiency" or so much "scientific management," just as they would purchase so many pounds of sugar or of flour. They seem to think that they can plaster this mysterious but definite commodity all over their business, which will subsequently run itself in a highly efficient or scientific manner without requiring any further attention from them. Nothing could be further from the truth. Under scientific industrial efficiency, executive decision based on guessing under casual management, is replaced by executive decision based on facts. Executive decision is quite as necessary under one type of management as under the other. The difference lies in the results.

Increasing Stress Upon Responsibility.—About fifteen years ago, the man at the head of a great coal property was widely ridiculed because of a statement of his to the effect that the large corporation is a sacred trust from on high—that the management of such a property is a responsibility bestowed by the Deity, by nature, by circumstances, or by fate. To a democratic public this theory savored too much of the divine right of kings. Recently, however, the same doctrine has assumed a new and more popular angle. H. G. Wells, in his recent analysis of European industrial conditions, writes:

But here, running through the thoughts of the Englishman and the Italian and the Frenchman and the American alike, one finds just the same idea of a kind of officialism in ownership. It is an idea that pervades our thought and public discussion today everywhere, and it is an idea that is scarcely traceable at all in the thought of the early half of the nineteenth century. The idea of service and responsibility in property has increased and is increasing, the conception of "hold-up", the usurer's conception of his right to be bought out of the way, fades.

The Keynote of Scientific Management.—Responsibility is the keynote of the new science of management. "Authority to" must be replaced by "responsibility for," to paraphrase H. L. Gantt. Once scientific management, which includes statistical control, has placed the facts in the hands of the executive, his responsibility begins and his duty lies clear before him. But the facts alone are not enough. Not long ago, an expert in the installation of systems of graphic control told me that his greatest difficulty was in "keeping the manager from jumping on his department heads." "As soon as a new chart was placed before the company's chief executive, disclosing unsuspected and appalling discrepancies, the first thing he did was to reach for his phone. Time and again I had to grab his hand to prevent him from calling some poor devil of a divisional superintendent on the carpet to face facts he never knew existed." Scientific management was needed in the factory, as well as charts in the office. It isn't fair to show up a man's deficiencies unless you are prepared to help him overcome

them. Destructive criticism of a man or of his department, leads to nothing except bitterness. You must not only show up the inefficiency, but you must supply the remedy.

Modern versus Ancient Practice.—Wherever the idea of authority rather than of responsibility prevails, there is the favorite lurking place of that superannuated crustacean who, in the blindness of selfishness, has taken for his motto: "I hold my men responsible for results—all I am interested in is results." The "result hog" became an anomoly when "tainted money" was discovered. Up to that time money—"never mind how you got it, but money"—measured success. The modern executive must add to his demands for "results," active personal assistance in attaining results. I do not mean that he should do the work of every incompetent assistant that he acquires or inherits, but I do mean that it is his duty to gauge the potential of his assistants, and to develop to the highest degree the latent powers of such as are capable of becoming effective executives. The modern executive is a teacher—he must be able to inspire his men to make effort and to self-development. He must assist them, send them forth upon trips of investigation, call in experts to help them solve their problems, induce them to study and improve themselves. Given a man with a high potential, and such a man's failure is a direct reflection upon his superior officer. The crab who "cares only for results" is becoming a relic of the past—now seen only in the geological strata disclosed by some financial up-

heaval when an antediluvian concern goes into bankruptcy. Responsibility is the watchword of the true executive—responsibility to his stockholders, responsibility to his assistants, responsibility to the public, responsibility to his own ideals. Let him remember responsibility, and his authority will take care of itself.

Getting Orders Carried Out.—Aside from the test of responsibility, the true measure of an executive lies in his ability to get his orders carried out. Any fool can give orders—it takes a man to make others do his bidding. Brute force is no longer sufficient. "Fire the superintendent," does not solve the industrial problem. The modern executive must have the facts. Lacking these, he cannot persuade his men, his fellow-executives, or his stockholders. True control is based upon an exact knowledge of existing conditions. The man who has the facts continually at his command, and who has taught his organization to act upon such facts, quickly, smoothly, and wisely, will lead his forces to that industrial success which is the measure of victory for the workmen, for the stockholders, and for the community. For such a man, personal success is a certainty.

APPENDIX A

MECHANICAL AIDS TO THE ASSEMBLY OF STATISTICS

Adding and Listing Machines.—For the sake of simplicity in the preceding pages I have discussed the assembly of data largely on the assumption that the more common methods of figuring "by hand" with the aid of an adding machine—such as the Burroughs or the Comptometer—would be used. No modern general office, and only the smallest and most primitive kind of factory office, can afford to do without at least one such machine. In the first place, a machine makes possible much more rapid figuring, and this means that a smaller clerical force may be maintained or that records will be more readily accessible, or both; and in the second place, the figuring is done more accurately by machine, so that the danger of the executive's making costly errors of judgment is greatly reduced.

The following description of such machines will make their use clear. This extract is from E. St. Elmo Lewis's very helpful book entitled "Efficient Cost Keeping," which is published by the Burroughs Adding Machine Company of Detroit, Michigan.

The Burroughs Adding and Listing Machine has two very definite and very distinct functions, both of which, however, are performed simultaneously by the same mechanism.

1. It writes down figures just as much more legibly than they can be written down by hand, as a typewriter writes letters more legibly than they can be written by hand. The writing is faster than on a typewriter, because several keys can be operated at a single motion, and all ciphers and punctuation print automatically where required.

2. It automatically adds all the figures it writes down, and is ready at any time, by the mere operation of a handle, to record, without the possibility of error, the absolutely correct total of all the figures written down, a total which has been accumulating in the machine during the writing operation.

Now, as more than 90 per cent of all the time of all the clerks who are employed in the accounting and cost departments of all the businesses of all the world, is spent in writing down, adding, and multiplying figures; and as the Burroughs Adding and Listing Machine writes with vastly greater speed than any man can write by hand, writes more legibly, more regularly, and in absolutely even columns—were this its only function, its existence would be more than justified; it would be a paying purchase at its price for almost any large business.

But the Burroughs does more than this for the addition of all the figures written down is done in literally no time at all; the mere writing of them down serves at the same instant automatically to add them, and, what is more important, to add them without the possibility of error.

As a matter of fact, it takes the average clerk about nine minutes to write down and add this column:

157.38
762.91
435.75
800.76
43.02
987.25
500.00
1,003.50
245.65
82.47
4,250,86
1,014.75
243.92
914.75
5,475.80
14,850.07
410.25
9.10
.74
27.72
896.35
1,238.63
7,800.00
10,000.00
127.34
77.01
303.24
3,808.89
458.92
1,456,789.34
11,025.22
600.10

2,250.85
14,823.45
8,207.12
2,100.00

1,552,723.11*

This isn't the fastest work that can be done, or the slowest.

But the most experienced bookkeeper in the world is absolutely obliged to check over his addition after he has made it, in order to be at all certain that his result is correct.

The average operator—here again, not the fastest or the slowest—can write down from the same data the same list of figures on the Burroughs Adding and Listing Machine in approximately a minute and a half.

When he has finished listing, the movement of a lever or the pressing of a bar prints the correct addition at the bottom of the column, and automatically maks the amount so printed as a total, by printing a star (*) beside it.

No amount of checking over can make a correct result more correct; and since the addition of the Burroughs Adding and Listing Machine cannot, by any possibility, be wrong, no checking is required.

Here is a clean saving of five-sixths of the time required for a very simple arithmetic proposition—the kind of work that most clerks are doing most of every day.

Take the matter of multiplying; suppose your cost

clerk has the following extensions on piece-work time tickets to make:

141 @ .12 a 100	57 @ .50 a 100
100 @ .50 a 100	568 @ .20 a 100
225 @ .20 a 100	

The average cost clerk, using paper and pencil, would require about 2 minutes to make these extensions and secure a total. An average Burroughs operator with a Calculating Machine can do the same work in 35 seconds. An expert can do it in 25 seconds.

The operation of the Burroughs Listing Machine is extremely simple. A boy or a girl can in a few minutes learn to operate it.

Figures are "put into" the machine by simply touching the tops of the keys. The figures are printed on paper in even columns and added by pulling a handle or, on the electrically operated machine, by touching a bar.

After each addition, the adding wheels show the total. This may be printed, at any time, by simply depressing a total key while the handle is moved forward.

The Burroughs subtracts, multiplies, and divides faster than the problem can be written down with paper and pencil.

There are special Burroughs machines fitted for handling all the problems of the cost-keeper.

Burroughs machines are built to handle your work as you are doing it now. It is not necessary to change your system to use a Burroughs.

The Burroughs Duplex is a very valuable time-

saving machine for handling costs. It is a machine with two sets of adding wheels, each of which will accumulate a total up to the full keyboard capacity of the machine. Thus, with a nine-column Burroughs Duplex, it is possible to list and total items aggregating eighteen columns; with a seventeen-column machine it is possible to list and total items aggregating thirty-four columns.

The Duplex is capable of doing three different classes of work.

First. It can list and add items like the regular Burroughs, and take totals and sub-totals.

Second. It can list and add groups of items, print the total for each group, and then give the grand total of all the groups. This is convenient for securing separate totals of each workman's earnings and a grand total of all, at one operation.

This is done by use of the Transfer Total Key, by which each group total is printed, cleared from the upper adding wheels, and transferred to the lower adding wheels, where the grand total is accumulated.

Third.—It can list and add two sets of items in one column or in separate columns, each of which can be accumulated into a total equal to the full capacity of the machine. This can be used in adding day-workers' earnings in upper adding wheels, piece-workers' in lower, and so on.

The operation of the two sets of accumulators is controlled by the Duplex lever, which is located at the left side of the keyboard. This is in a convenient location for the operation of the lever with the left hand.

When the lever is set in the position of "Upper Counter," items listed are accumulated in the upper set of adding wheels. When in the "Lower Counter" position, the items are accumulated in the lower set of adding wheels.

Following are some of the things which a Duplex Burroughs will handle in a Cost Department:

With the machine it is possible to secure the cost of jobs by departments, together with the grand total for all departments, at one handling of the figures.

A total of the payroll can be obtained for each department of a plant, and a grand total for all departments can be printed without putting the department totals back into the machine.

Total labor cost can be secured by accounts, together with the grand total of cost, at one operation.

Each sheet of a payroll can be totaled and a grand total of the entire roll secured, at one operation.

Cost and selling price can both be added and listed at one operation in the same or in separate columns on the sheet, and the items can be marked to distinguish the cost price from the sales price.

The total weekly or monthly earnings of each workman, and a grand total for all workmen, can be obtained at one operation.

The Burroughs Unlimited Split feature greatly increases the possibilities of the Burroughs for payroll work, because it permits the handling of several columns at the same time.

It enables the operator to divide the machine into as many adding sections as he desires. This is done by means of small levers at the top of keyboard. For

instance, a fifteen-column Duplex machine equipped with Unlimited Split device may be divided so that you can add six columns of five figures each at the same time. If you wish some of these columns not to add, the levers can be so arranged instantly.

The name "Unlimited Split" is well chosen, because the machine has unlimited possibilities. The levers can be changed in a fraction of a minute, because there is no complicated mechanism.

In handling payrolls with this device, the employee's number, hours worked, and amount of pay can be run off at one operation.

With the Duplex Unlimited Split Machine, by using this method instead of taking a grand total each time the department payroll is finished, the operator can take a transfer total. Thus he secures separate totals of the hours and amounts in departments, and the grand total of hours and amounts for the entire payroll is accumulated in the lower adding wheels.

The Burroughs Machine used in a great many cost departments is the Burroughs Duplex with 15 or 17 columns' adding and listing capacity (30 or 34 columns with Duplex feature). This machine is electrically operated, and may have a carriage for handling sheets 12¼″ or 18″ wide. It may have the Unlimited Split Device so that the keyboard may be divided into two or more adding sections. A machine may be arranged to add hours and minutes, or whole numbers and fractions.

Thus the workman's time and earnings can be written and added at one operation by dividing the keyboard into two sections.

One of the greatest advantages of a listing machine for such work as this lies in the fact that every step of the calculation is printed on the paper. When printed lists are not required, greater speed can be obtained on the Burroughs Calculator.

A very little practice soon makes a machine operator quite expert in multiplying, and when once he has mastered the operation he will never want to give up using the machine.

The Burroughs Calculating Machine (non-listing) is a great assistance to the cost keeper in figuring time tickets, pro-rating, and all work requiring division, multiplication, subtraction, and addition when no printed record is necessary.

This is a light, portable machine which can easily be carried around the office and takes up little room.

This machine does not print figures, but the result of any operation is always plainly visible on the adding wheels. Merely depressing the key causes the amount indicated on the surface to be added in its column. It is not necessary to pull the handle until you wish to clear the machine for new calculations.

The machine can be operated by the touch method, and great speed in performing mathematical operations can be attained with a little practice.

The Burroughs Calculating Machine and an average clerk will easily handle 750 extensions an hour.

Besides the machines arranged to add and list dollars and cents, special machines can be furnished to add any kind of compound numbers, such as feet and inches; dozens and gross; fractions of 1/4, 1/8, 1/12, 1/16, 1/32, 1/64; hours and minutes; tons and hun-

dredweights; pounds and bushels; grains and pennyweights; pounds, shillings, and pence; or any other data in the way of foreign money, dates and amounts.

The foregoing description by Mr. Lewis of the Burroughs machines, although fairly lengthy is not extravagant in its claims. I have included it here, for I have seen in many factories so great a loss of effort in the billing and accounting departments that could easily have been reduced by the use of the machines described. Other devices for similar purposes have been recently placed on the market, and several typewriter manufacturers have perfected their machines in such manner as to make them invaluable for listing and billing purposes.

Computing and Tabulating Machines.—In addition to adding and listing machines there is a group of what is known as "Computing and Tabulating Machines," which operate on quite a different principle. One of the best known is the Hollerith Tabulating Machine, Figure 88, which compiles statistics automatically at great speed. The information to be assembled is entered upon cards, similar to the ones shown in Figure 89, by means of a key punch with keys something like a typewriter. When a portion of the information to be entered upon a card is common to a number of cards—such as the date and department on a group of time cards—a gang punch is used which punches holes in all the cards at once.

Any sort of information may be compiled, as the same mechanism fits any situation. The variation occurs in the cards, which are printed to suit each class of information it is desired to gather.

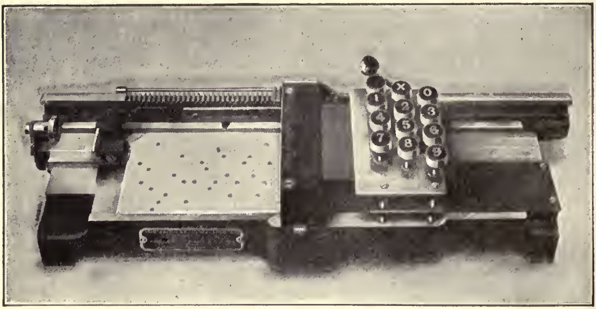


FIG. 88. HOLLERITH KEY PUNCH FOR PERFORATING CARDS

As soon as the information has been punched on the cards, the stack of cards is placed in a sorting machine, Figure 90, which automatically divides them according to a predetermined arrangement. This is effected by means of electric contacts, made when the punched hole in the card passes over a brush terminal in the machine. The cards are sorted at a speed of about 250 per minute into pockets in the machine, and are then placed in racks and left there until called for by the tabulating-machine operator.

The tabulating machine adds the numerical amounts from statistical divisions on the cards at the rate of 150 cards per minute, and renders the statement of the statistical information desired. The system is of immense value where large quantities of data are required at short notice. The outfit is leased to users by the Tabulating Machine Company, of New York City, at a rate which roughly approximates the monthly salary of one clerk. Concerns of sufficient

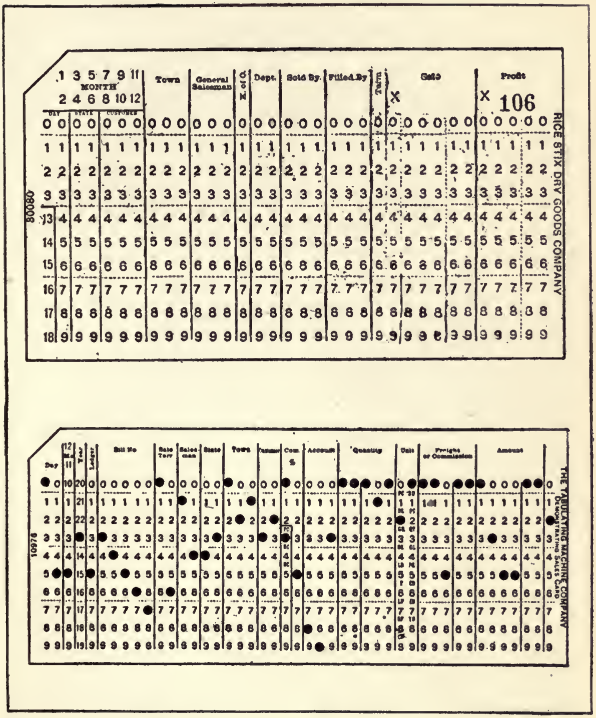


FIG. 89. HOLLERITH MACHINE CARDS

An unpunched card above, and a punched one below.

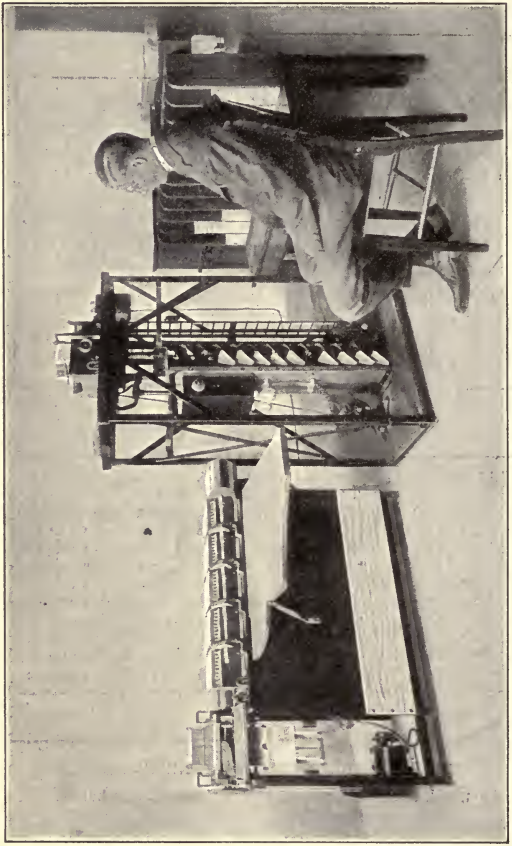


FIG. 90. HOLLERITH SORTING MACHINE FOR SORTING THE PUNCHED CARDS

size to keep two men busy on statistical, payroll, and stockroom figuring should very carefully consider the installation of some such mechanical system, as it is quicker, more accurate, and renders possible considerably more work per man employed, than the usual statistical methods in use.

A reprint of a very interesting paper read by W. E. Freeman before the National Electric Light Association at its San Francisco Convention, is distributed by the Powers Accounting Machine Company, of New York. This booklet begins with a description of the first "difference engine" built by Charles Babbage, in 1820, and carries the story of the improvement in accounting machines down to the present day. The Hollerith machine described above is covered, as are also the Powers and Pierce Machines.

The powers accounting machine uses punched cards similar to those used in the Hollerith machine. These are sorted on a somewhat different type of sorting machine, and are then fed into what is called a "Tabulator-Printer," Figure 91, which not only registers the results but prints them on record sheets, Figure 92.

The Pierce System is described by Mr. Freeman as using a card on which the information is written or printed as well as punched. Three machines are used: a perforating machine, a distributing machine, and an automatic ledger machine.

Mr. Freeman's paper discusses mechanical accounting in connection with accounting systems for public-service corporations, and treats at some length of the adaptation of graphic charts for presenting accounts

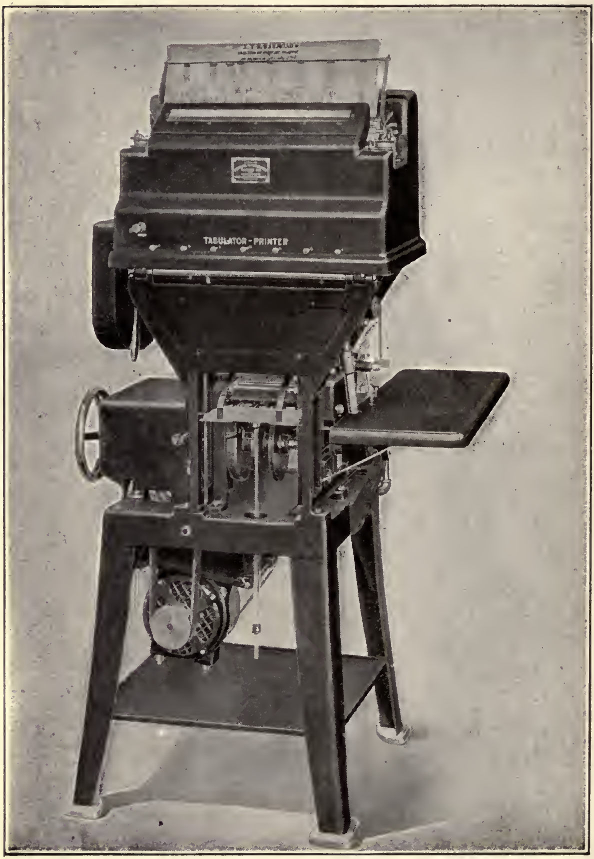
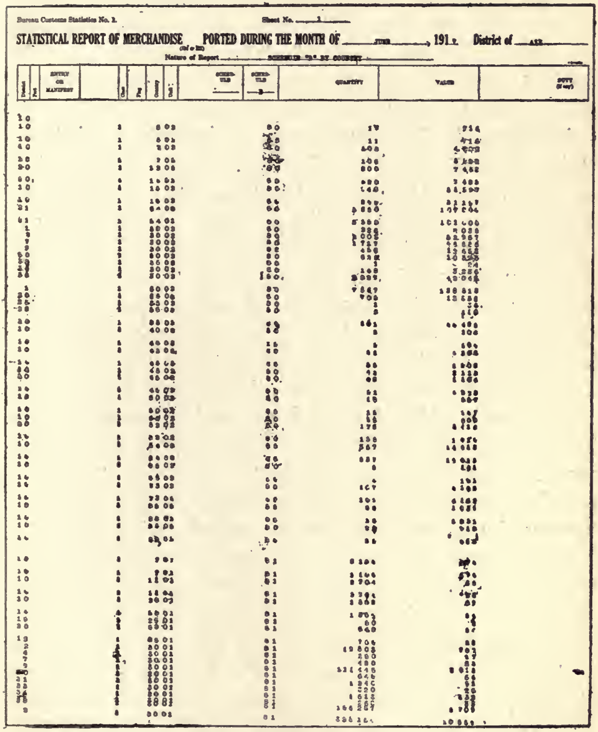


FIG. 91. POWERS TABULATOR-PRINTER


Bureau Customs Statistics No. 1.

Sheet No. 1

STATISTICAL REPORT OF MERCHANDISE PORTED DURING THE MONTH OF ____, 191_ District of ____

Nature of Report

ENTRY OR MANIFEST					SCHEDULE	SCHEDULE	QUANTITY	VALUE	DUTY (if any)

FIG. 92. SAMPLE OF WORK PERFORMED BY POWERS TABULATOR-PRINTER

Original size of sheet, 16 by 18 inches.

in classified order, closing with a summary various papers read before the National Electric Light Association dealing with the subject of punching, counting, sorting, and tabulating machines. The booklet should be read by every one who desires to make a thorough study of the subject.

Mechanical Classification of Executive Data.—Quite recently there has been placed upon the market a mechanical device for locating filed information with extreme rapidity. The principle of the Bertillon system is generally known, by means of which a card containing a criminal's record may be located among ten thousand other cards by classification according to physical characteristics. The man under suspicion is first classified, for instance, as having brown hair. That differentiates him from all the black-haired, red-haired and yellow-haired men, and eliminates, say, seven thousand cards. He is then classified according to height as, say, six feet. Whereupon all the five-foot-and-a-fraction men are eliminated from among the remaining three thousand, and only a few hundred cards are left to peruse. It is then noted that his forearm is 18 inches long—and the number of cards is cut down to a few dozen, perhaps. It is then noted that he has a wart on the end of his nose, and he is finally located as the only brown-haired, six-foot, eighteen-inch-forearm, wart-nosed man among ten thousand criminals, and is clapped into jail.

The Findex Company, by means of a similar selective classification coupled with a punching and sorting system, has made it possible to locate mechanic-

ally any filed data almost instantly. In a recent letter Leo S. Robinson, President of the Company, describes the working of the system as follows:

"The 'Findex' may be described as a ledger for posting executive decisions, or any facts other than dollars and cents. From a long study of the principles involved in 'Findex' treatment, we find that it is common for the executive to be called upon to decide the same question over and over again, and every time he is compelled to go into the original records, examine the facts, weigh their relative importance, and make a judicial determination. In the case of accounts in a ledger, it occurred to me that the entry of a certain digit in a certain column on a certain page on the ledger, accompanied by a notation of the date, is in reality an executive decision. It reveals to the observer the fact that some time in the past (we do not know when) an order, and possibly a considerable amount of correspondence and many other papers, have been executed, but all that interests us is the fact that out of the whole transaction there was evolved a debit against the man whose name is written at the top of the page for a certain amount, which is indicated by the entry. We do not have to waste any time to go further than this, except in a case of a question of the entry, when, of course, we can look up the details of the transaction which lead to the entry.

"The 'Findex' provides a method of posting other facts quite similar to that of the ledger. Referring to the card (Figure 93) you will note that Position No. 111 (Sings) has been slotted, which indicates

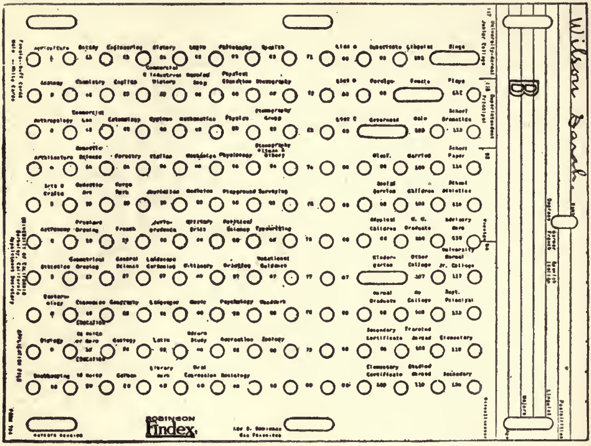


FIG. 93. SAMPLE OF FINDEX CARD

that Miss Wilson sings. Hereafter, for all time, her card is in the 'Findex', and every time we are asked for any one who sings, her card will appear. The details of how we have decided who can sing, are immaterial; the main point is to eliminate from the consideration of the executive all those who do not sing. There are in this file of 1800, 1600 women, of whom, say, 25 per cent—or 400—can sing. There are, we may say, of these 1600, 100 who have had kindergarten training, but of the 400 who can sing, possibly only 40 would fall into the group of 100 with kindergarten experience. As we want a woman who is a governess, in which class there would be, say, 50, we might say that of these 50 only 20 would have kinder-

garten experience, and of these 20 who have kindergarten experience only 10 can sing. Now, the problem is for the executive to select, with due regard for economy of time, a female applicant for kindergarten wok, who is an experienced governess and who can sing (four attributes). The procedure with the 'Findex' is as follows:

"'Findex' rods are introduced into Position No. 93—Governess; No. 97—Kindergarten; No. 102—Female; No. 111—Sings. We thus lock in their place in the container the cards of all applicants who do not fall within all of these classes, and there are mechanically selected 10 cards, bearing the names of the 10 women with these qualifications. The availability and the relative merits of these ten are matters for executive decision, and by the operation of the 'Findex' the executive is relieved of the consideration of 1790 names, none of which will fulfill all of the conditions imposed. He therefore confines himself to the ten available names and gives them such study as the case requires, making a selection according to his judgment. The saving of time is evident, to say nothing of the feeling of finality which results from this method.

"It is my personal opinion that the 'Findex' has by no means as yet received the full measure of recognition which is coming to it. We must expect that this, like other new things, will establish itself slowly, but we have had the most remarkable success with the installations already working. In the instance referred to above, we have made a saving, on the average, of eight cards to each applicant, which

would be over 14,000 cards on the 1800 list. We avoid the possibility of error resulting from a misfiling of this great mass of cards, and we save the executive the vexation and annoyance of having to handle them, to say nothing of the monetary saving, which could easily be figured to equal the cost of the system.

"This discovery was the result of my own personal troubles in handling index cards. I found this one of the most annoying things I ever had to do, and I conceived the idea that whenever cross-indexing was necessary it should be done by some mechanical means which would not necessitate the making of duplicate cards.

"In order to apply the 'Findex' in any line of business it is necessary that a study be made somewhat similar to the study made by an accountant before determining the ledger headings and opening a set of books. In the 'Findex' system these headings indicate the pertinent attributes of the units classified. We start with the assumption that every individual is negative in every attribute, and when the study determines that any particular individual is no longer negative in any particular point, his card is slotted, to indicate that there is no negative hindrance, and to prevent his card from being locked in position when the 'Findex' rod is introduced in this particular hole. What the 'Findex' rod really does is to lock in the cards of all the individuals who do not possess certain qualifications.

APPENDIX B

MISCELLANEOUS AND BIBLIOGRAPHY

Ratio Charts.—Professor Irving Fisher, of Yale University, in Quarterly Publications of the American Statistical Association, has written an exhaustive account of the advantages of the "Ratio Chart," the use of which I illustrated in Chapter VII in connection with the discussion of the advantages of logarithmic or "arithlog" platting paper under certain circumstances. Professor Fisher's article is well worth careful study, and I have availed myself of his permission to quote certain extracts from it which set forth the advantages of this type of chart under some conditions.

"We may compare any two magnitudes of like kind, by means either of their difference or of their ratio. In the first kind of comparison 'an inch on the end of one's nose' is exactly as much as an inch added to the height of the Washington Monument; in the second kind of comparison, on the other hand, 'an inch on the end of one's nose' is an addition of about 40 per cent, or as much as 220 feet added to the height of the Monument.

"The ordinary chart is adapted to difference comparisons rather than to ratio comparisons, whereas the statistician is usually concerned with ratio com-

parisons far more than with difference comparisons."

The value of this type of chart from the standpoint of the graphic interpretation of facts, is later summarized:

"The eye reads a ratio chart more rapidly than a difference chart or a table of figures. We may recapitulate what most easily catches the eye:

1. If we see a curve ascending, and nearly straight, we know that the statistical magnitude it represents is increasing at a nearly uniform rate.

2. If the curve is descending, and nearly straight, the statistical magnitude is decreasing at a nearly uniform rate.

3. If the curve bends upward, the rate of growth is increasing.

4. If downward, decreasing.

5. If the direction of the curve in one portion is the same as in some other portion, it indicates the same percentage rate of change in both.

6. If the curve is steeper in one portion than in another portion, it indicates a more rapid rate of change in the former than in the latter.

7. If two curves on the same ratio chart run parallel, they represent equal percentage rates of change.

8. If one is steeper than another, the first is changing at a faster percentage rate than the second.

9. The imaginary straight line most nearly representing, to the eye, the general trend of the curve, is its 'growth axis,' and represents the average rate of increase (or decrease); and the deviations of the curve from this growth axis are plainly evident without recharting.

10. The slope of the imaginary line between any two points on a curve indicates the average rate of change between the two, and is illustrated by the charts here given. (See Figures 94, 95, and 96.)

"Figures 94 and 95, taken from a brief article of mine in the 'New York Times Analyst' show a type of error taken from actual statistics. Figure 94 gives the impression that the prices of breadstuffs have fluctuated less than the prices of 'all commodities.' On the ratio chart, however, as shown in Figure 95, although exactly the same numbers are plotted, it is seen that breadstuffs have actually fluctuated a trifle more violently than 'all commodities.'

"For comparing in detail any two curves on ratio charts, such as those in Figure 95, we may do what we have just seen is not properly permissible on a difference chart,—we may move bodily either curve, the upper curve ownward or the lower curve upward, until the two are close together. Then the various degrees of parallelism or divergence at various periods of time, may be seen with the utmost clearness. This is done in Figure 96. Such close comparison will usually give quickly, through the eye, a better practical picture, I think of the degree of correlation and certainly of the location of the correlation than can be obtained even by the various calculations of coefficients of correlation."

Bibliography of Cartography.—I would recommend that any man who intends to install a system which is to any degree extensive make a careful study of the various methods of platting statistics. Willard C. Brinton's book on "Graphic Methods for Present-

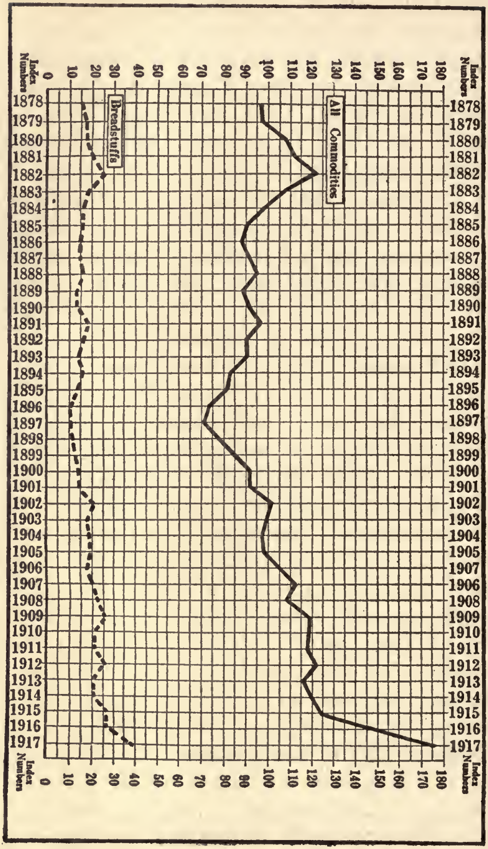


FIG. 94. INDEX NUMBERS COMPARED BY THE DIFFERENCE METHOD (FISHER)
Apparently "all commodities" have fluctuated more than "breadstuffs."

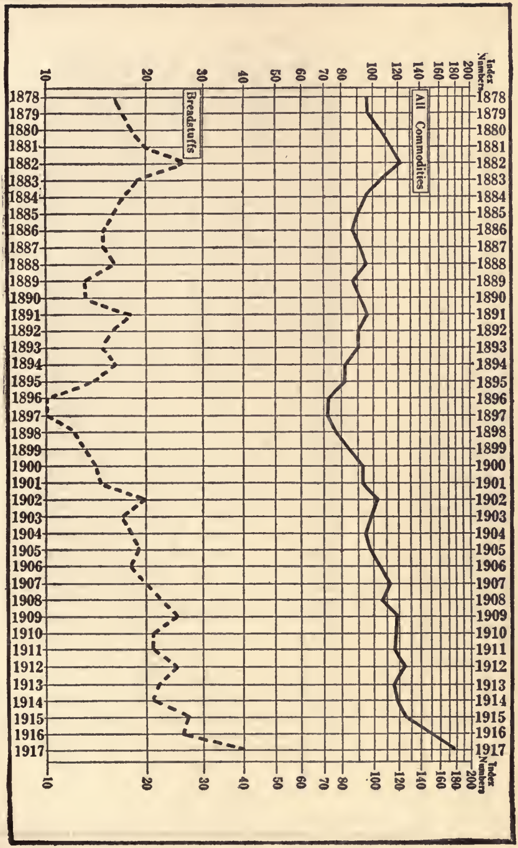


FIG. 95. INDEX NUMBERS COMPARED BY THE RATIO METHOD (FISHER)

In actuality, "breadstuffs" fluctuate more than "all commodities."

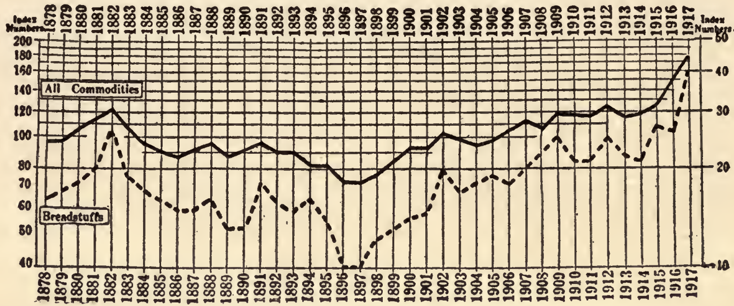


FIG. 96. RATIO METHOD. THE SAME AS FIGURE 95 (FISHER)

The contrast is shown more sharply by bringing the curves closer together. This procedure is legitimate in the ratio method, but not in the difference method. The scale on the right applies to the lower curve, that on the left to the upper.

ing Facts" should be studied carefully, since it illustrates the correct methods of graphic representation as well as the methods which are misleading. To the man who would go more deeply into the subject, the following bibliography, taken from Professor Fisher's article, may prove of assistance.

JEVONS, W. S., *Investigations in Currency and Finance*, Macmillan, London, pp. 53, 128, 150.

MARSHALL, ALFRED, *On the Graphic Method of Statistics*, Jubilee Volume of the Royal Statistical Society, June 22-24, 1885, p. 258.

WOOD, GEORGE H., *Some Statistics Relating to Working Class Progress Since 1860*, Journal of the Royal Statistical Society, December 1899, p. 660.

BOWLEY, ARTHUR L., *Elements of Statistics*, King, London, pp. 188-196.

BENINI, R., *Principie di Statistica Metodologica*, Unione Tipografico-Editrice Torinese, Turin, pp. 144-148.

BRINTON, WILLARD C., *Graphic Methods for Presenting Facts*, The Engineering Magazine Company, New York, pp. 132-7.

BRINTON, WILLARD C., and others, *Preliminary Report of the Joint Committee on Standards for Graphic Presentation*, 1915, p. 5. Printed by the American Society of Mechanical Engineers.

FISCHER, IRVING, *Plotting Ratios long with Amounts*, New York Times Annalist, March 19, 1917, p. 398.

WENZEL, JOHN, *Graphic Charts*, Scientific American Supplement, No. 2154, April 14, 1917, p. 236.

Bibliography of Management.—Certain other books of a more general nature have been found extremely helpful at times—some for their inspirational value,

others for the concrete suggestions that they contain. For the sake of the reader just beginning the study of scientific industrial efficiency, the following list of titles is included:

GOWIN, E. B., *The Executive and His Control of Men—A Study in Personal Efficiency,* MacMillan, New York City.

JONES, EDWARD D., *The Business Administrator,* The Engineering Magazine Co., New York City.

HINE, CHARLES DE LANO, *Modern Organization,* The Engineering Magazine Co., New York City.

KNOEPPEL, C. E., *Installing Efficiency Methods,* The Engineering Magazine Co., New York City.

EMERSON, HARRINGTON, *Efficiency as a Basis for Operation and Wages,* The Engineering Magazine Co., New York City.

EMERSON, HARRINGTON, *The Twelve Principles of Efficiency,* The Engineering Magazine Co., New York City.

GANTT, H. L., *Work, Wages and Profits,* The Engineering Magazine Co., New York City.

GANTT, H. L., *Industrial Leadership,* Yale University Press, New Haven.

TAYLOR, F. W., *Principles of Scientific Management,* Harper & Bros., New York City.

TAYLOR, F. W., *Shop Management,* Harper & Bros., New York City.

GILBRETH, FRANK B., *Motion Study,* Van Nostrand, New York City.

SHADWELL, ARTHUR, *Industrial Efficiency—Contrasted in England, Germany and America,* Longmans, Green & Co., New York City.

Fundamentals of a Cost System for Manufacturers, Federal Trade Commission, Government Printing Office, Washington.

THOMPSON, C. B., *Scientific Management*, Harvard University Press, Cambridge.

GOING, CHARLES B., *Methods of the Santa Fe*, The Engineering Magazine Co., New York City.

VANDEVENTER, JOHN H., *Machine Shop Management*, McGraw-Hill Book Co., New York City.

TAYLOR, F. W., *The Art of Cutting Metals*, Transactions American Society of Mechanical Engineers.

The above mentioned book by C. B. Thompson contains a very complete bibliography covering books and articles written on the subject of Scientific Management up to the date of this publication. Pamphlets covering and describing the books published by them respectively may also be obtained from the following publishing houses:

The Engineering Magazine Co., 6 E. 39th St., New York City.

The McGraw-Hill Book Co., 239 W. 39th St., New York City.

D. Van Nostrand Co., 23 Murray St., New York City.

Harper & Bros., Franklin Sq., New York City.

A. W. Shaw Co., Chicago, Ill.

Periodicals of Management.—The following publications will be found to contain many helpful articles to the student of management:

The Bulletins of the Taylor Society, obtainable from the Office of the Secretary, Hanover, N. H., contain many scholarly articles.

Industrial Management (formerly The Engineering Magazine) published at 6 East 39th St., New York City, is the medium of expression for the foremost industrial engineers in

the country, and is of particular assistance to the manager as well as to the engineer.

The Journal of the American Society of Mechanical Engineers, published at 29 W. 39th St., New York City, while largely devoted to the subjects implied by its title, contains many articles dealing with the executive and industrial engineering aspects of the business.

The 100% Magazine, published at 327 South La Salle St., Chicago, is the official organ of The Western Efficiency Society.

The Bulletins of The New York Efficiency Society, 52 Broadway, New York City.

The magazines, "System" and "Factory" published by A. W. Shaw Co., Wabash Ave., Chicago.

While the above lists are intended in no way to be complete, I believe that the man in seach of more light on the subject of definite and effective management, by following the leads indicated, may uncover much that will prove of benefit to him. You cannot "learn out of a book how to run a business," but you can learn from a book how to do better what you are doing. You can learn to look ahead and you can learn to look upward and, after all, that is about all there is to success.

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